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(54) **METHOD AND APPARATUS FOR ALLOCATING IP ADDRESS IN WIRELESS P2P COMMUNICATION NETWORK**

VERFAHREN UND VORRICHTUNG FÜR DIE ZUWEISUNG DER IP-ADRESSE IN EINEM DRAHTLOSEN P2P KOMMUNIKATIONSNETZWERK

PROCÉDÉ ET APPAREIL D'ATTRIBUTION D'ADRESSE IP DANS UN RÉSEAU DE COMMUNICATION P2P SANS FIL

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates generally to a method and an apparatus for allocating an Internet Protocol (hereinafter referred to as 'IP') address in a wireless communication network, and more particularly, although not exclusively, to a method for allocating an IP address between terminals in a wireless communication network in which the terminals directly communicate with each other in a wireless scheme without using an access point (hereinafter referred to as 'AP'), and an apparatus thereof.

BACKGROUND OF THE INVENTION

[0002] Among wireless communication technologies, a wireless fidelity (hereinafter referred to 'Wi-Fi') direct network technology is a technology which enables Wi-Fi terminals to be connected to each other in a peer-to-peer (hereinafter referred to as 'P2P') fashion, without requiring an AP to act as a medium as part of the network infrastructure. Most existing Wi-Fi technologies are aimed at only connecting a terminal with the Internet through a Wireless Local Area Network (WLAN) AP, whereas direct communication between terminals is not considered. Direct communication between terminals may be achieved, for example, by using Bluetooth technology. However, performance, in terms of transmission distance and transmission speed, of Bluetooth technology is typically low compared with Wi-Fi Direct technology.

[0003] Existing Wi-Fi technology supports a mode in which direct communication between terminals is possible, called an Ad-hoc mode. However, since the Ad-hoc mode is disadvantageous is some respects, for example since security is weak, power consumption is high, and throughput is limited (e.g. to 11Mbps), the Ad-hoc mode is rarely used in practice.

[0004] The Wi-Fi direct technology supports Wi-Fi Protected Access® 2 (WPA2) to supplement weakness of security. Further, the Wi-Fi Direct technology supports simple connection between terminals using a Wi-Fi Simple Configuration (hereinafter referred to 'WSC'). Moreover, the Wi-Fi direct technology provides an improved power consumption algorithm by supporting IEEE 802.11n to significantly improve throughput as compared with the Ad-hoc mode.

[0005] The Wi-Fi direct technology is a protocol based on IEEE 802.11, and is compatible with a legacy client. The Wi-Fi direct technology may be upgraded in a terminal without changing hardware.

[0006] Although Wi-Fi direct technology has considerable advantages as illustrated above as compared with Bluetooth and the Ad-hoc technology, there is a need for improvement, for example in connection speed between terminals. The terminals perform an IP address allocation procedure after connection between the terminals is completed. That is, since the IP address allocation procedure is further performed after the connection between the terminals is completed, there is a limitation on improvement in connection speed. In particular, when one of the terminals is determined as a Group Owner (hereinafter referred to 'GO'), a corresponding terminal performs an AP function. That is, the GO drives a Dynamic Host Configuration Protocol (hereinafter referred to 'DHCP') server to allocate an IP address to another terminal, namely, a group client (hereinafter referred to 'GC').

[0007] A technique for IP address assignment is described in Mohsin, M. et al, "IP address assignment in a mobile ad-hoc network", Military Communications Conference, MILCOM, Proceedings, IEEE, October 2002, vol. 2, pages 856-861. The Wi-Fi Direct technology is described in "Wi-Fi Peer-to-Peer (P2P) Technical Specification - Draft Version 1.14" provided by the Wi-Fi Alliance Technical Committee.

SUMMARY OF THE INVENTION

[0008] It is an aim of certain exemplary embodiments of the present invention to address, solve, mitigate or obviate, at least partly, at least one of the problems and/or disadvantages associated with the related art, for example the above-discussed deficiencies. Certain embodiments aim to provide at least one of the advantages described below. Accordingly, certain embodiments of the present invention provide a method for easily and rapidly allocating an IP address between terminals in a wireless communication network, and an apparatus thereof.

[0009] In accordance with an aspect of the present invention, there is provided a method for allocating an Internet Protocol (IP) address to a group client (GC), the method performed by a wireless terminal capable of performing peer-to-peer (P2P) communication according to the Wi-Fi Alliance Wi-Fi P2P Specification, the method comprising: discovering at least one external terminal capable of performing the P2P communication and initiating a connection with the at least one discovered external terminal; negotiating and determining with the external terminal which of the terminal and the external terminal becomes a group owner (GO) performing a function of an access point and which becomes the GC performing a function of a station in a P2P group; and completing the connection, wherein one of the discovering and the negotiating includes transmitting or receiving an IP address to be allocated to the group client to or from the external terminal.

[0010] In accordance with another aspect of the present invention, there is provided an apparatus for allocating an Internet Protocol (IP) address to a group client (GC), the apparatus forming part of a wireless terminal capable of performing peer-to-peer (P2P) communication according to the Wi-Fi Alliance Wi-Fi P2P Specification, the apparatus comprising: a Wi-Fi module configured to support wireless communication based on an IP

address, and perform a function of an access point or a station in the P2P communication; and a controller configured to control the Wi-Fi module to transmit a frame for discovering at least one external terminal, capable of performing the P2P communication and initiating a connection with the at least one discovered external terminal, and a frame for negotiating and determining with the external terminal which of the terminal and the external terminal becomes a group owner (GO) performing a function of an access point and which becomes the GC performing a function of a station in a P2P group, wherein the controller is configured to complete the connection, and control the Wi-Fi module to transmit or receive an IP address to be allocated to the group client to or from the external terminal during one of the discovering and the negotiating.

[0011] An exemplary embodiment of the present invention provides a computer program comprising instructions arranged, when executed, to implement a method and/or apparatus, in accordance with any one of the above-described aspects. A further exemplary embodiment provides machine-readable storage storing such a program.

[0012] Other aspects, advantages, and salient features of the invention will become apparent to those skilled in the art from the following detailed description, which, taken in conjunction with the annexed drawings, disclose exemplary embodiments of the invention.

[0013] The following description of exemplary embodiments of the present invention, with reference to the accompanying drawings, is provided to assist in a comprehensive understanding of the present invention, as defined by the claims. The description includes various specific details to assist in that understanding but these are to be regarded as merely exemplary. Accordingly, those of ordinary skill in the art will recognize that various changes and modifications of the embodiments described herein can be made without departing from the scope of the invention.

[0014] Before undertaking the DETAILED DESCRIPTION OF THE INVENTION below, it may be advantageous to set forth definitions of certain words and phrases used throughout this patent document: the terms "include" and "comprise," as well as derivatives and variations thereof, mean inclusion without limitation; the term "or," is inclusive, meaning and/or; the phrases "associated with" and "associated therewith," as well as derivatives thereof, may mean to include, be included within, interconnect with, contain, be contained within, connect to or with, couple to or with, be communicable with, cooperate with, interleave, juxtapose, be proximate to, be bound to or with, have, have a property of, or the like; and the term "controller" means any device, system or part thereof that controls at least one operation, such a device may be implemented in hardware, firmware or software, or some combination of at least two of the same. It should be noted that the functionality associated with any particular controller may be centralized or distributed, whether locally or remotely.

[0015] Throughout the description and claims of this specification, the singular encompasses the plural unless the context otherwise requires. In particular, it is to be understood that the singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise. Thus, for example, reference to "an object" includes reference to one or more of such objects. It will be also be appreciated that, throughout the description and claims of this specification, language in the general form of "X for Y" (where Y is some action, activity or step and X is some means for carrying out that action, activity or step) encompasses means X adapted or arranged specifically, but not exclusively, to do Y.

[0016] Definitions for certain words and phrases are provided throughout this patent document, those of ordinary skill in the art should understand that in many, if not most instances, such definitions apply to prior, as well as future uses of such defined words and phrases. The terms and words used in the following description and claims are not limited to the bibliographical meanings, but, are merely used by the inventor to enable a clear and consistent understanding of the invention. Accordingly, it should be apparent to those skilled in the art that the following description of exemplary embodiments of the present invention is provided for illustration purpose only and not for the purpose of limiting the invention as defined by the appended claims.

[0017] Features, integers, characteristics, compounds, chemical moieties or groups described in conjunction with a particular aspect, embodiment or example of the invention are to be understood to be applicable to any other aspect, embodiment or example described herein unless incompatible therewith.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] For a more complete understanding of the present invention and its advantages, reference is now made to the following description taken in conjunction with the accompanying drawings, in which the same or similar reference numerals may represent the same or similar parts, although they may be illustrated in different drawings:

FIG. 1 illustrates a network configuration of a P2P group according to an exemplary embodiment of the present invention;

FIG. 2 illustrates a flowchart of a P2P connection method according to an exemplary embodiment of the present invention;

FIG. 3 illustrates a flowchart of discovery according to an exemplary embodiment of the present invention;

FIG. 4 illustrates a flowchart of provision discovery according to an exemplary embodiment of the present invention;

FIG. 5 illustrates a flowchart of a negotiation proce-

dure according to an exemplary embodiment of the present invention;

FIG. 6 illustrates a flowchart of a negotiation procedure according to another embodiment of the present invention;

FIG. 7 illustrates a flowchart of a method for allocating an IP according to a first embodiment of the present invention;

FIG. 8 illustrates a flowchart of a method for allocating an IP according to a second embodiment of the present invention;

FIG. 9 illustrates a flowchart of a method for allocating an IP according to a third embodiment of the present invention;

FIG. 10 illustrates a flowchart of a method for allocating an IP according to a fourth embodiment of the present invention;

FIG. 11 illustrates a flowchart of a method for allocating an IP according to a fifth embodiment of the present invention;

FIG. 12 illustrates a diagram of an example of a GO Negotiation Confirmation frame according to an exemplary embodiment of the present invention;

FIG. 13 illustrates a flowchart of a method for allocating an IP according to a sixth embodiment of the present invention; and

FIG. 14 illustrates a block diagram of a configuration of a portable terminal according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0019] FIGURES 1 through 14, discussed below, and the various embodiments used to describe the principles of the present invention in this patent document are by way of illustration only and should not be construed in any way to limit the scope of the invention. Those skilled in the art will understand that the principles of the present invention may be implemented in any suitably arranged system or device.

[0020] A method and an apparatus for allocating an IP address according to exemplary embodiments of the present invention are described with reference to the accompanying drawings in detail. The same reference numbers are used throughout the drawings to refer to the same or like parts. Detailed descriptions of well-known functions, processes, constructions and structures incorporated herein may be omitted for clarity and conciseness, and to avoid obscuring the subject matter of the present invention.

[0021] In the exemplary embodiments described herein, the term "terminal" refers to a peer to peer (P2P) device including a Wi-Fi direct technology acting as a GO and a GC in a Wi-Fi direct network. In the exemplary embodiments described herein, the term "P2P group" refers to one terminal set configured by one GO and one or more GCs in the Wi-Fi direct network. The GC is connected to the GO. The GO communicates with a GC, and performs an AP function relaying communication between particularly GCS. The skilled person will appreciate that the present invention is applicable to any terminal that is capable of connecting to another terminal, for example with a direct connection between terminals without using an access point or other intermediate entity. The present invention is also applicable to wireless technology other than W-Fi. The present invention may use addresses other than IP addresses. Other variations and modifications of the specific exemplary embodiments described herein falling within the scope of the present invention will readily occur to the skilled person.

[0022] FIG. 1 illustrates a network configuration of a P2P group according to an exemplary embodiment of the present invention. Referring to FIG. 1, the GO may connect with a plurality of GCS. The GO may connect with one GC. The number of admissible clients may be determined according to a performance of the GO. Such a performance may be a hardware performance and/or a software performance, which may be, for example, a charge level of a battery. When a battery of the GO is charged greater than 80% (e.g. the power remaining is 80% of maximum), the GO may be connected with four GCs as shown. If the charging rate of the battery is less than 50%, the GO may be connected with one GC. The number of the GCs connected with the GO may be determined by the user in environment setting of the terminal. In certain exemplary embodiments, the P2P device is a terminal including the Wi-Fi direct technology, although any other suitable type of device may be used. For example, the P2P device may be a portable terminal (e.g., tablet PC, notebook PC), a printer, a projector, and a digital TV.

[0023] FIG. 2 illustrates a flowchart of a P2P connection method according to an exemplary embodiment of the present invention. Referring to FIG. 2, a P2P device discovers a neighboring P2P device, and performs connecting with the discovered P2P device (step 210). A purpose of the discovery is to discover P2P devices such that devices may connect with each other as soon as possible. The discovery includes a device discovery and a provision discovery. The device discovery is configured by two steps, namely, a scan step and a find step. A probe request frame and a probe response frame are used in the device discovery to exchange information between the devices. When the P2P device itself is a GO or in a listen state, the P2P device may respond to a probe request frame received from another P2P device. Further, the P2P device itself is a GO and may transmit a beacon frame. If the P2P device is not included in a group, the P2P device may be in a listen state. That is, the P2P device in the listen state responds to a received probe request frame.

[0024] The P2P device in the listen state selects a listen channel from a social channel list. For example, according to a Wi-Fi P2P Technical Specification suggested by the Wi-Fi Alliance Technical Committee, channels 1, 6, and 11 may be used as a social channel in 2.4GHz band.

For example, when channel 1 is selected, the P2P device may receive a probe request frame through the channel 1, but may not receive the probe request frame through other channels. When the device discovery starts, the listen channel may be selected and remain until the discovery is terminated. If a preset time elapses, the listen channel may be changed to another channel. A 2.4GHz band is used and there are a total of 14 channels in the IEEE 802.11. An interval between channels is 5MHz, each having a 22MHz band. The channels are not independent from each other but overlap with each other. However, three channels 1, 6, and 11 among the 14 channels do not interfere with each other.

[0025] The scan step in the device discovery is a step of discovering a P2P device or a P2P group. Further, the scan step is a step of discovering the most suitable channel to set the P2P group. That is, in the scan step, the P2P device scans all supported channels to collect information from a neighboring device or network. In the scan step, the P2P device may not respond to a probe request frame.

[0026] The find step in the device discovery is a step which P2P devices existing in the same channel transceive a message to find each other. The P2P device waits for reception of the probe request frame in the listen state. When the probe request frame is received, the P2P device transmits a probe response frame to a P2P device of the other party. The P2P device may change the listen state to a discover state. In a discover state, the P2P device transmits the probe request frame and the P2P device of the other party receives the probe response frame in response to the probe request frame. The probe response frame includes a device name, device attribute information, and vendor information. The P2P device may display the information such that the user may confirm the information.

[0027] The P2P device discovered for each other through the device discovery may be connected to each other. First, the P2P device performs provision discovery with a P2P device of the other party wishing connection. When the P2P device attempts connection with a P2P device of the other party in a Personal Identification Number (PIN) or a Push Button Configuration (PBC) mode of WSC, the provision discovery informs a user of the connection attempt. The P2P device receives a provision discovery request frame for the provision discovery, and informs the user of message contents through a pop-up. The pop-up includes information of the P2P device having requested the provision discovery such as a device name. The requested use of the P2P device determines presence of admittance and a WSC of the connection. To inform the P2P device of the other party of the presence of admittance of the connection, the P2P device transmits a provision discovery response frame to the P2P device of the other party.

[0028] When the provision discovery is completed, the P2P device negotiates a function with the P2P device of the other party (step 220). In this procedure, a P2P device determined as the GO perform a function of the AP, and a P2P device determined as a GC perform a function of a station. In particular, in certain embodiments of the present invention, in this procedure, the GC receives allocation of an IP address from the GO. The IP address may be a private IP address usable in a local area, namely, a corresponding P2P group. The P2P device stores a private IP address list. For instance, the private IP address may be "165.213.30.2-254". P2P devices in the P2P group transceives a message to determine the GO. In this example, the message may include a private IP address. That is, the P2P device may select an optional private IP address from the private IP address list, and transmits a message including the selected private IP address to another P2P device. The P2P device determined as a GC from the P2P group sets a private IP address as the P2P device's IP address.

[0029] Negotiation of the function is completed, the P2P device exchanges information necessary for P2P communication, for example, a network key, an encryption type, a Service Set Identification (SSID), an Authentication type with the P2P device of the other party to complete P2P connection (230).

[0030] FIG. 3 illustrates a flowchart of discovery according to an exemplary embodiment of the present invention. Referring to FIG. 3, it is assumed that a first P2P device 310 and a second P2P device 320 participate in discovery. A user of the first P2P device 310 commands the first P2P device 310 to perform P2P connection (step 311). That is, the user operates an input unit included in the first P2P device 310, for example, a touch screen for P2P connection. Then, the touch screen transfers an input touch event to a controller of a device. The controller detects the P2P connection, namely, a command of device discovery from the input touch event. The first P2P device 310 firstly performs scan in response to the command of the device discovery (step 312). For example, the first P2P device 310 scans channels 1, 6, and 11 of IEEE 802.11 to collect information from a neighboring P2P device. After completing the scan, the first P2P device 310 performs a find step. Meanwhile, a user of the second P2P device 320 commands the second P2P device 320 to perform the discovery (321). Accordingly, the second P2P device 320 firstly performs scan in response to a command of the user (322). After completing the scan, the second P2P device 320 performs a find step.

[0031] The first P2P device 320 enters a listen state (step 313). The first P2P device 310 selects channel 1 as the listen channel. If a preset time elapses, the first P2P device 320 enters a discover state (step 314). The first P2P device 310 firstly selects channel 1 to transmit a probe request frame in the discover state. When there is no response, the first P2P device 310 selects channel 6 to transmit the probe request frame. In this example, the second P2P device 320 is in a listen state with respect to channel 6. Accordingly, the second P2P device 320 receives a probe request frame through channel 6, and transmits a probe response frame through the channel

6 in response thereto. The first P2P device 310 receives a probe response frame through the channel 6. The first P2P device 310 displays information of the probe response frame, for example, a device name, device attribute information, vendor information such that the user may confirm the foregoing information. The user may determine presence of admittance of connection based on the information.

[0032] FIG. 4 illustrates a flowchart of provision discovery according to an exemplary embodiment of the present invention. Referring to FIG. 4, it is assumed that a first P2P device 410 and a second P2P device 420 participate in provision discovery. The first P2P device 410 and the second P2P device 420 discovered to each other through the device discovery may be connected to each other. A user of the first P2P device 410 commands the first P2P device 410 to admit connection. For example, the user operates an input unit included in the first P2P device 310, for example, a touch screen for P2P connection. Then, the touch screen transfers an input touch event to a controller of a device. The controller detects admittance of connection, namely, a command of device discovery from the input touch event.

[0033] The first P2P device 410 firstly transmits a provision discovery request frame to the second P2P device 420 in response to the command of the provision discovery (step 401). In this example, the provision discovery request frame includes an IP address. The IP address in the provision discovery request frame may be a private IP address. Particularly, the private IP address included in the provision discovery request frame may be one of "165.213.30.2-254".

[0034] The second P2P device 420 transmits a provision discovery response frame to the first P2P device 410 in response to reception of the provision discovery request frame (step 402). In this example, according to certain embodiments of the present invention, the provision discovery response frame may include an IP address, namely, a private IP address.

[0035] FIG. 5 illustrates a flowchart of a negotiation procedure according to an exemplary embodiment of the present invention. Referring to FIG. 5, the first P2P device 510 and the second P2P device 520 are in a state which perform discovery to find each other. The first P2P device 510 transmits a GO Negotiation Request frame to the second P2P device 520 (step 510). According to certain embodiments of the present invention, the GO negotiation request frame includes a P2P Information Element (IE), WSC information (IE), an IP address.

[0036] The IP address of the GO negotiation request frame may be private IP address. The IP address of the GO negotiation request frame may be one of "165.213.30.2-254".

[0037] That is, the first P2P device 510 may optionally select one private IP address from a private IP address list, and transmits the GO negotiation request frame including the selected private IP address. However, for example, "165.213.30.2-10" is a share to be allocated to a third P2P device, and may be excluded in the selection. Here, the third P2P device is a P2P device requesting entry to a P2P group as a P2P client after negotiation is completed. That is, a P2P device determined as the GO may allocate one of the "165.213.30.2-10" to the third P2P device.

[0038] The P2P information of the GO negotiation frame may include device information, a Configuration Timeout, a Listen Channel, a listen channel list, and a Group Owner Intent (hereinafter referred to as 'GOI'). Here, the GOI is a numeric value indicating intention of a P2P device, namely, a first P2P device 510 having transmitted a corresponding message becoming a GO. That is, when the GOI value is great, there is a great possibility which a corresponding P2P device is determined as a GO. The range of the GOI may previously be set. For example, 0-15 may be the range of the GOI. A P2P device selects a value from the GOI range based on the P2P device's performance, in a GO negotiation request frame, and transmits the GO negotiation request frame including the selected value. For example, when the P2P device receives power supply from a notebook PC and an external commercial power supply, the P2P device may select 15 as the GOI.

[0039] The second P2P device 520 receives a GO negotiation request frame from a first P2P device 510, and transmits a GO negotiation response frame in response thereto (step 502). According to certain embodiments of the present invention, the GO negotiation response frame includes a P2P Information Element (IE), WSC information (IE), and an IP address.

[0040] As describe above, an IP address of the GO negotiation response frame may be a private IP address. Particularly, the private IP address included in the GO negotiation response frame may be one of "165.213.30.2-254". However, "165.213.30.2-10" may be omitted because of the foregoing reason. P2P information of the GO negotiation response frame may include device information, a Configuration Timeout, a Listen Channel, a listen channel list, and a GOI.

[0041] As described above, the first P2P device 510 and the second P2P device 520 exchange the GOI to determine the GO. For example, when the GOI selected by the first P2P device 510 is 10 and the GOI selected by the second P2P device 520 is 5, the first P2P device 510 is determined as the GO and the second P2P device 520 is determined as a GC. Accordingly, the first P2P device 510 performs a function of an AP in a corresponding P2P group, and the second P2P device 520 performs a function of a station in the corresponding P2P group. Further, because the first P2P device 510 is determined as the GO, the second P2P device 520 allocates an IP address received from the first P2P device 510 as the second P2P device's 520 IP address.

[0042] The first P2P device 510 transmits a GO Negotiation Confirmation Frame to the second P2P device 520 to notify that the second P2P device 520 is determined as the GC (step 503).

[0043] FIG. 6 illustrates a flowchart of a negotiation procedure according to another embodiment of the present invention. Referring to FIG. 6, the first P2P device 610 and the second P2P device 620 are in a state which perform discovery to find each other. The first P2P device 610 transmits a GO Negotiation Request frame to the second P2P device 620 (step 610). According to certain embodiments of the present invention, the GO negotiation request frame includes a P2P Information Element (hereinafter referred to as 'IE'), and WSC IE. The P2P information of the GO negotiation frame may include device information, a Configuration Timeout, a Listen Channel, a listen channel list, and a GOI. Here, the GOI is a numeric value indicating intention of a P2P device, namely, a first P2P device 610 having transmitted a corresponding message becoming a GO. The GOI was described above.

[0044] The second P2P device 620 receives a GO negotiation request frame from a first P2P device 610, and transmits a GO negotiation response frame in response thereto (step 602). According to certain embodiments of the present invention, the GO negotiation response frame includes a P2P IE and a WSC IE.

[0045] As described above, the first P2P device 610 and the second P2P device 620 exchange the GOI to determine the GO. For example, the GOI selected by the first P2P device 610 is greater than that selected by the second P2P device 620, so that the first P2P device 610 may be determined as a GO. Accordingly, the first P2P device 610 performs a function of an AP in a corresponding P2P group, and the second P2P device 620 performs a function of a station in the corresponding P2P group.

[0046] The first P2P device 610 transmits a GO Negotiation Confirmation Frame the second P2P device 620 to notify that the second P2P device 520 is determined as the GC (step 603). In particular, according to certain embodiments of the present invention, the GO Negotiation Confirmation Frame may include an IP address. Here, as described above, the IP address may be a private IP address. The second P2P device 620 allocates an IP address received from the first P2P device 610 determined as the GO as the second P2P device's 520 IP address.

[0047] Hereinafter, various embodiments of the present invention implementing a method for allocating an IP will be described with reference to FIGS. 7 to 13. It is apparent that a method for allocating an IP address according to the present invention is not limited to following embodiments. Prior to the description, for convenience of the description, P2P devices participating in negotiation are limited to a first P2P device and a second P2P device. It is apparent that a main body of the description in FIGS. 7 to 9 is a first P2P device.

[0048] FIG. 7 illustrates a flowchart of a method for allocating an IP according to a first embodiment of the present invention. Referring to FIG. 7, a first P2P device selects a GOI value X_1 from a preset GOI range (e.g., 0-15) (step 701). Further, the first P2P device selects an optional IP address from a private IP address list (step 701). The first P2P device transmits the selected GOI value X_1 and IP address to the second P2P device (step 702). In this example, the X_1 and IP address may be transmitted to be included in a GO negotiation request frame or a GO negotiation response frame. The first P2P device receives a GOI value X_2 and an IP address from the second P2P device (step 703). Here, the GOI value X_2 and IP address are already received, step 703 is omitted.

[0049] The first P2P device determines whether the received GOI value X_2 is identical with the transmitted GOI value X_1 (step 704). When the received GOI value X_2 is identical with the transmitted GOI value X_1, negotiation fails. Accordingly, the first P2P device and the second P2P device may again exchange the GOI value. In this example, the IP address may be again exchanged or not.

[0050] When the received GOI value X_2 differs from the transmitted GOI value X_1, the first P2P determines whether the received GOI value X_2 is greater than the transmitted GOI value X_1 (step 705). When the received GOI value X_2 is greater than the transmitted GOI value X_1, the first P2P device determines itself as a GC (706). The first P2P device allocates the received IP address as the first P2P device's IP address (707). Accordingly, the first P2P device may perform a function of the station. In the meantime, the second P2P device determines itself as a GO. Accordingly, the second P2P device may perform a function of an AP. When the received GOI value X_2 is less than the transmitted GOI value X_1, the first P2P device determines itself as a GO (step 708). Further, the second P2P device determines itself as a GC.

[0051] FIG. 8 illustrates a flowchart of a method for allocating an IP according to a second embodiment of the present invention. Referring to FIG. 8, a first P2P device selects a GOI value X_1 from a preset GOI range (e.g., 0-15) (step 801). The first P2P device transmits the selected GOI value X_1 to the second P2P device (step 802). In this example, the X_1 may be transmitted to be included in a GO owner negotiation request frame or a GO negotiation response frame. The first P2P device receives a GOI value X_2 from the second P2P device (step 803). Here, the GOI value X_2 is already received, step 803 is omitted.

[0052] The first P2P device determines whether the received GOI value X_2 is identical with the transmitted GOI value X_1 (step 804). When the received GOI value X_2 is identical with the transmitted GOI value X_1, negotiation fails. Accordingly, the first P2P device and the second P2P device may again exchange the GOI value.

[0053] When the received GOI value X_2 differs from the transmitted GOI value X_1, the first P2P device determines whether the received GOI value X_2 is greater than the transmitted GOI value X_1 (step 805). When the received GOI value X_2 is greater than the transmitted GOI value X_1, the first P2P device determines itself as a GC (step 806). After that, the first P2P device receives an IP

address from the second P2P device, and allocates the received IP address as the first P2P device's IP address (step 807). The IP address may be received to be included in the GO negotiation confirmation frame.

[0054] When the received GOI value X_2 is less than the transmitted GOI value X_1, the first P2P device determines itself as a GO (step 808). The first P2P device selects an optional IP address from a private IP address list, and transmits the selected IP address to the second P2P device (step 809).

[0055] FIG. 9 illustrates a flowchart of a method for allocating an IP according to a third embodiment of the present invention. Referring to FIG. 9, a first P2P device selects a GOI value X_1 from a preset GOI range (e.g., 0~15) (step 901). Further, the first P2P device selects an optional IP address from a private IP address list (step 901). In addition, the first P2P device selects a tie break value T_1 (step 901). Here, the tie break is a value used to determine a GO when GOI values collide (are identical) with each other. The tie break value may be in an ascending or descending sequence in a preset range. For example, when the first P2P device preempts '0' as the tie break value, the second P2P device may select '1' being a next value as the tie break value.

[0056] The first P2P device transmits the selected GOI value X_1, tie break value T_1, and IP address to the second P2P device (step 902). In this example, the X_1, T_1, and IP address may be transmitted to be included in a GO negotiation request frame or a GO negotiation response frame. In this example, the T_1 may not be transmitted to be included in a GO negotiation request frame or a GO negotiation response frame. That is, the tie break value may not be exchanged between two P2P devices. In other words, because a P2P device of the two P2P devices having transmitted a request frame preempts the tie break value, exchange of the tie break value may not be necessary.

[0057] The first P2P device receives a GOI value X_2, a tie break value T_2, and an IP address from the second P2P device (step 903). Here, the GOI value X_2, tie break value T_2, and IP address are already received, step 903 is omitted. A tie break value T_2 may not be received.

[0058] The first P2P device determines whether the received GOI value X_2 is identical with the transmitted GOI value X_1 (step 904). When the received GOI value X_2 differs from the transmitted GOI value X_1, the first P2P determines whether the received GOI value X_2 is greater than the transmitted GOI value X_1 (step 905). When the received GOI value X_2 is greater than the transmitted GOI value X_1, the first P2P device determines itself as a GC (step 906). Further, the second P2P device determines itself as a GO. The first P2P device allocates a received IP address as the first P2P device's IP address (step 907).

[0059] When the received GOI value X_2 is less than the transmitted GOI value X_1, the first P2P device determines itself as a GO (step 908). Further, the second P2P device determines itself as a GC.

[0060] When the received GOI value X2 is identical with the transmitted GOI value X1, the first P2P device determines whether the X1 and X2 are less than 15 (here, 15 is a maximum value of the GOI range) (step 909). When the X1 and X2 are 15, exchange of the GOI value may be again performed. Although both of the X1 and X2 are 15, the process may go to step 910. That is, step 909 may be omitted.

[0061] When both of the X_1 and X_2 are less than 15, the first P2P device compares the T_2 with the T_1, and determines a function thereof based on the comparison result (step 910). That is, when the T_1 is greater than T_2, the first and second P2P devices may be determined as a GO and a GC, respectively. Conversely, when the first and second P2P devices may be determined as a GC and a GO, respectively.

[0062] When the first P2P2 device is determined as the GC through the comparison result of the T_2 with the T_1, the first P2P device allocates the received IP address as the first P2P device's IP address (step 911). When the first P2P device is determined as the GO, step 911 is omitted.

[0063] FIG. 10 illustrates a flowchart of a method for allocating an IP according to a fourth embodiment of the present invention. Referring to FIG. 10, a first P2P device selects a GOI value X_1 from a preset GOI range (e.g., 0-15) (step 1001). Further, the first P2P device selects a tie break value T_1 (step 1001). The tie break value may be in an ascending or descending sequence in a preset range.

[0064] The first P2P device transmits the selected GOI value X_1 and tie break value T_1 to the second P2P device (step 1002). In this example, the X_1 and T_1 may be transmitted to be included in a GO negotiation request frame or a GO negotiation response frame. In this example, the T_1 may not be transmitted to be included in a GO negotiation request frame or a GO negotiation response frame. That is, the tie break value may not be exchanged between two P2P devices.

[0065] The first P2P device receives a GOI value X_2 and a tie break value T_2 from the second P2P device (step 1003). Here, the GOI value X_2 and the tie break value T_2 are already received, step 1003 is omitted. A tie break value T_2 may not be received.

[0066] The first P2P device determines whether the received GOI value X_2 is identical with the transmitted GOI value X_1 (step 1004). When the received GOI value X_2 differs from the transmitted GOI value X_1, the first P2P determines whether the received GOI value X_2 is greater than the transmitted GOI value X_1 (step 1005). When the received GOI value X_2 is greater than the transmitted GOI value X_1, the first P2P device determines itself as a GC (step 1006). Further, the second P2P device determines itself as a GO. The first P2P device receives an IP address from the second P2P device and allocates a received IP address as the first P2P device's IP address (step 1007). The IP may be received to be included in a GO negotiation confirmation frame.

[0067] When the received GOI value X_2 is less than the transmitted GOI value X_1, the first P2P device determines itself as a GO (step 1008). Further, the second P2P device determines itself as a GC. Further, the first P2P device selects an optional IP address from a private IP address list and transmits the selected IP address to the second P2P device (step 1009).

[0068] When the received GOI value X_2 is identical with the transmitted GOI value X_1, the first P2P device determines whether the X_1 and X_2 are less than 15 (here, 15 is a maximum value of the GOI range) (step 1010). When the X_1 and X_2 are 15, exchange of the GOI value may be again performed. Although both of the X_1 and X_2 are 15, the process may go to step 1011. That is, step 1010 may be omitted.

[0069] When both of the X_1 and X_2 are less than 15, the first P2P device compares the T_2 with the T_1, and determines a function thereof based on the comparison result (step 1011). That is, when the T_1 is greater than T_2, the first and second P2P devices may be determined as a GO and a GC, respectively. Conversely, when the first and second P2P devices may be determined as a GC and a GO, respectively.

[0070] When the first P2P2 device is determined as the GC through the comparison result of the T_2 with the T_1, the first P2P device allocates the received IP address as the first P2P device's IP address (step 1012). Meanwhile, when the first P2P device is determined as the GO, the first P2P device selects an optional IP address from a private IP address list and transmits the selected optional IP address to the second P2P device (step 1012).

[0071] FIG. 11 illustrates a flowchart of a method for allocating an IP according to a fifth embodiment of the present invention. Referring to FIG. 11, a first P2P device selects a GOI value X_1 from a preset GOI range (e.g., 0-15) (step 1101). The first P2P device transmits the selected GOI value X_1 to the second P2P device (1102). In this example, the X_1 may be transmitted to be included in a GO negotiation request frame or a GO negotiation response frame. The first P2P device receives a GOI value X_2 from the second P2P device (step 1103). Here, the GOI value X_2 is already received, step 1103 is omitted.

[0072] The first P2P device determines whether the received GOI value X_2 is identical with the transmitted GOI value X_1 (step 1104). When the received GOI value X_2 is identical with the transmitted GOI value X_1, the first P2P device and the second P2P device may again exchange the GOI value.

[0073] When the received GOI value X_2 differs from the transmitted GOI value X_1, the first P2P determines whether the received GOI value X_2 is greater than the transmitted GOI value X_1 (step 1105). When the received GOI value X_2 is greater than the transmitted GOI value X_1, the first P2P device determines itself as a GC (step 1106). After that, the first P2P device receives an IP address from the second P2P device, and allocates the received IP address as the first P2P device's IP address (step 1107). Here, the IP address is received from the second P2P device through provision discovery. Meanwhile, the second P2P device determines itself as a GO.

[0074] When the received GOI value X_2 is less than or equal to the transmitted GOI value X_1, the first P2P device determines itself as a GO (step 1108). Further, the second P2P device determines itself as a GC.

[0075] FIG. 12 illustrates a diagram of an example of a GO Negotiation Confirmation frame according to an exemplary embodiment of the present invention. Referring to FIG. 12, a GO negotiation confirmation frame may include a vendor specific 1210. Further, the vendor specific 1210 may include a private IP address 1020, for instance, "165.213.30.23". That is, the P2P device may select one from "165.213.30.2-254" and includes the selected IP address in a GO negotiation confirmation frame, and transmit the GO negotiation confirmation frame to a P2P device of the other party. The P2P device may include the selected IP address in a GO negotiation request frame or a GO owner negotiation response frame, and the corresponding to the P2P device of the other party. For example, "165.213.30.2-10" is a share to be allocated to a third P2P device, and may be excluded in the selection.

[0076] FIG. 13 illustrates a flowchart of a method for allocating an IP according to a sixth embodiment of the present invention. Referring to FIG. 13, a first P2P device 1310 is in a state completing connection with a second P2P device (not shown) through discovery and negotiation procedures. Further, the first P2P device 1310 is in a state determined as a GO in the negotiation procedure. Further, the first P2P device 1310 and a third P2P device 1320 are in a state discovered through the device discovery. The third P2P device 1320 transmits a provision discovery request frame to the first P2P device 1310 in this state (step 1301). The first P2P device 1310 transmits a provision discovery response frame to the third P2P device 1320 in response to reception of the provision discovery request frame (step 1302). In this example, according to certain embodiments of the present invention, the provision discovery response frame may include an IP address, particularly, a private IP address. The third P2P device 1320 allocates the received IP address as the third P2P device's IP address and participates in a P2P group in which the first P2P device 1310 is a GO.

[0077] As described above, the P2P device according to embodiments of the present invention is applicable to electronic devices of various forms. For example, the P2P device in certain embodiments of the present invention is applicable to a portable terminal. It will be apparent that the portable terminal may be in the form of any suitable type of information and communication device and/or multi-media device, for example a portable phone, a smart phone, a tablet PC, a net book PC, a notebook PC, a Portable Multimedia Player (PMP), an electronic book (e-book) reader, a Personal Digital Assistant (PDA), a digital broadcasting player, a music player (e.g., MP3

player), a portable game terminal, and application devices thereof.

[0078] FIG. 14 illustrates a block diagram of a portable terminal according to an exemplary embodiment of the present invention. Referring to FIG. 14, a portable terminal 1400 according to this exemplary embodiment of the present invention may include a touch screen 1410, a key input unit 1420, a display unit 1430, a memory 1440, a radio frequency (RF) communication unit 1450, and a controller 1460.

[0079] The touch screen 1410 is mounted in front of the display unit 1430, generates a touch event in response to a user gesture input to the touch screen 1410, and transfers the generated touch event to the controller 1460. Accordingly, the controller 1460 may detect the touch event input from the touch screen 1410 to control the foregoing components.

[0080] The key input unit 1420 may include a plurality of input keys and function keys for receiving input of numerals and character information and for setting various functions. The key input unit 1420 generates and transfers a key signal associated with user setting and function control of the portable terminal 1400 to the controller 1460. The controller 1460 controls the foregoing components in response to the key signal.

[0081] The display unit 1430 converts image data input from the controller 1460 into an analog signal, and displays the analog signal under control of the controller 1460. That is, the display unit 1430 may provide various screens according to use of the portable terminal, for example, a lock screen, a home screen, an application execution screen, a menu screen, a keypad screen a message creation screen, and an Internet screen. The display unit 1430 may be configured by a flat panel display such as a Liquid Crystal Display (LCD), an Organic Light Emitted Diode (OLED), or an Active Matrix Organic Light Emitted Diode (AMOLED).

[0082] The memory 1440 may store an operating system (OS), applications necessary for operation, and various data. The memory 1440 may chiefly include a program area and a data area. The data area of the memory 140 may store data generated by the portable terminal 1400 or data downloaded from the outside (i.e. external to the portable terminal 1400), namely, images, documents, video, messages, mails, music, and effect sounds. Further, the data area may store the screen displayed on the display unit 1430. Moreover, the data area may temporarily store data which the user copies messages, photographs, web pages, or documents for copy and paste. In addition, the data area may store various setting values (e.g., screen brightness, presence of vibration when a touch occurs, presence of automatic rotation of a screen) for operating the portable terminal. Further, the data area may include a private IP address list 1441. The program area of the memory 1440 may store an operating system (OS) for booting the portable terminal and the foregoing components, and various applications. In particular, the program area stores programs associated with an operation and control of a Wi-Fi direct terminal such as device discovery, provision discovery, and negotiation.

[0083] The RF communication unit 1450 performs a voice call, an image call or data communication under control of the controller 1460. To do this, the RF communication unit 1450 may include an RF transmitter up-converting a frequency of a transmitted signal and amplifying the signal and an RF receiver low-noise-amplifying a received signal and down-converting the signal. Further, the RF communication unit 1450 may include mobile communication modules (e.g., a 3-Generation mobile communication module, a 3.5-Generation mobile communication module, or a 4-Generation mobile communication module, etc.) and a Wi-Fi module.

[0084] The Wi-Fi module 1451 supports wireless communication based on an IP of the portable terminal 1400. In certain embodiments of the present invention, the Wi-Fi module 1451 performs a function of an AP or a station under control of the controller 1460. In other words, the Wi-Fi module 1451 acts as a GO or a GC under control of the controller 1460.

[0085] The Wi-Fi module 1451 performs device discovery, provision discovery, and negotiation. Particularly, the Wi-Fi module 1451 may include an IP address in a Provision Discovery Request Frame, a Provision Discovery Response Frame, a GO Negotiation Request Frame, a GO Negotiation Response Frame, or a GO Negotiation Configuration Frame, and transmit the corresponding frame under control of the controller 1460. Further, the Wi-Fi module 1451 may receive the IP address included in the Provision Discovery Request Frame, the Provision Discovery Response Frame, the GO Negotiation Request Frame, the GO Negotiation Response Frame, or the GO Negotiation Configuration Frame, and transfer the received IP address to the controller 1460.

[0086] The controller 1460 controls an overall operation of the portable terminal 1400, signal flow between internal components of the portable terminal 1400, and processes data. Further, the controller 1460 controls power supply to the internal components in a battery. Moreover, the controller 1460 executes various applications stored in the program area.

[0087] The controller 1460 may receive an event from the touch screen 1410 or the key input unit 1420, and detect command of the discovery from the received event. The controller 1460 controls the Wi-Fi module 1451 to perform the device discovery in response to the command of device discovery. The controller 1460 controls the Wi-Fi module 1451 to perform the provision discovery in response to the command of the provision discovery.

[0088] The controller 1460 may select a private IP address to be transmitted from a private IP address list 1441, and control the Wi-Fi module 1451 to transmit the selected private IP address. The controller 1460 may receive the private IP address from an external device, namely, a P2P device through the Wi-Fi module 1451.

As a negotiation result, when the portable terminal 1400 is determined as a GC, the controller 1460 allocates the received private IP address as an IP address of the portable terminal 1400, and operates the Wi-Fi module 1451 as a GC. As a negotiation result, when the portable terminal 1400 is determined as a GO, the controller 1460 operates the Wi-Fi module 1451 as a GO.

[0089] The skilled person will appreciate that various structural elements in embodiments of the present invention can be variously omitted, modified, substituted and/or changed, for example according to convergence trend of digital devices. For example, the portable terminal 1400 in the embodiments described above may further include constructions that are not mentioned, for example a digital broadcasting module (e.g., DMB module), a GPS module, and a camera module. For example, the terminal 1400 of the embodiments described above may be substituted by specific constructions according to desired form or design requirements.

[0090] It will be appreciated that embodiments of the present invention can be realized in the form of hardware, software or a combination of hardware and software. For example, the foregoing method for allocating an Internet Protocol address in exemplary embodiments of the present invention may be implemented in an executable program command form by various computer means and be recorded in a computer readable recording medium. In this example, the computer readable recording medium may include a program command, a data file, and a data structure individually or a combination thereof. In the meantime, the program command recorded in a recording medium may be specially designed or configured for embodiments of the present invention or be known to a person having ordinary skill in a computer software field to be used. The computer readable recording medium includes Magnetic Media such as hard disk, floppy disk, or magnetic tape, Optical Media such as Compact Disc Read Only Memory (CD-ROM) or Digital Versatile Disc (DVD), Magneto-Optical Media such as optical disk, and a hardware device such as ROM. RAM, flash memory storing and executing program commands. Further, the program command includes a machine language code created by a complier and a high-level language code executable by a computer using an interpreter. The foregoing hardware device may be configured to be operated as at least one software module to perform an operation of embodiments of the present invention.

[0091] It will be appreciated that the storage devices and storage media are embodiments of machine-readable storage that are suitable for storing a program or programs comprising instructions that, when executed, implement embodiments of the present invention. Accordingly, embodiments provide a program comprising code for implementing apparatus or a method as claimed in any one of the claims of this specification and a machine-readable storage storing such a program. Still further, such programs may be conveyed electronically via any medium such as a communication signal carried over a wired or wireless connection and embodiments suitably encompass the same.

[0092] Embodiments of the present invention provide a method for easily and rapidly allocating an IP address between terminals in a wireless communication network, and an apparatus thereof. Embodiments of the present invention can allocate an IP address without driving a DHCP server. Therefore, connection speed and usability between terminals are improved.

[0093] Although a method and apparatus for allocating an IP address according to exemplary embodiments of the present invention have been described in detail hereinabove, it should be clearly understood that the invention is solely defined in the appended claims.

Claims

1. A method for allocating an Internet Protocol, IP, address to a group client, GC, the method performed by a wireless terminal (410, 510, 610, 1310) capable of performing peer-to-peer, P2P, communication according to the Wi-Fi Alliance Wi-Fi P2P Specification, the method comprising:

   discovering (210) at least one external terminal (420, 520, 620, 1320) capable of performing the P2P communication and initiating a connection with the at least one discovered external terminal (420, 520, 620, 1320);
   negotiating (220) and determining with the external terminal (420, 520, 620, 1320) which of the terminal and the external terminal becomes a group owner, GO, performing a function of an access point and which becomes the GC performing a function of a station in a P2P group; and
   completing the connection,
   wherein one of the discovering (210) and the negotiating (220) includes transmitting or receiving an IP address to be allocated to the group client to or from the external terminal (420, 520, 620, 1320).

2. The method of claim 1, wherein the negotiating (220) comprises:

   exchanging (501, 502) a frame including a first group owner intent value indicating intention of the wireless terminal (510) becoming the group owner and the IP address with the external terminal (520) by the wireless terminal (510);
   transmitting (503) a group owner negotiation confirmation frame indicating that the wireless terminal (510) is determined as a group owner by the wireless terminal (510) when the first group owner intent value transmitted from the wireless terminal (510) is greater than a second

group owner intent value received from the external terminal (520); and
allocating an IP address from the external terminal (520) as an IP address of the wireless terminal (510) by the wireless terminal (510) when the first group owner intent value transmitted from the wireless terminal (510) is less than the second group owner intent value.

3. The method of claim 2, wherein the frame includes a group owner negotiation request frame or a group owner negotiation response frame.

4. The method of claim 2 or 3, wherein exchanging the frame comprises:

selecting (701) one group owner intent value from the preset group owner intent range by the wireless terminal (410);
selecting (701) one private IP address from a private IP address list by the wireless terminal (410);
transmitting (702) the group owner negotiation request frame including the selected group owner intent value and the one selected private IP address to the external terminal by the wireless terminal (410); and
receiving (703) a group owner negotiation response frame from the external terminal (420) by the wireless terminal (410),
wherein the group owner negotiation response frame is a frame including a group owner intent value and a private IP address which the external terminal (420) transmits in response to the group owner negotiation request frame.

5. The method of any preceding claim, wherein the discovering comprises:

selecting one private IP address from a private IP address list by the wireless terminal (410);
transmitting (401) a provision discovery request frame including the one selected private IP address to the external terminal (420) by the wireless terminal (410); and
receiving (402) a provision discovery response frame from the external terminal (420) by the wireless terminal (410), wherein the provision discovery response frame is a frame including a private IP address which the external terminal (420) transmits in response to the provision discovery response frame.

6. The method of claim 5, wherein the negotiating comprises:

exchanging (702, 703) a frame including a group owner intent value indicating intention of the wireless terminal (410) becoming the group owner as a numeric value with the external terminal (420) by the wireless terminal (410);
when the first group owner intent value transmitted (702) from the wireless terminal (410) is greater than the second group owner intent value received (703) from the external terminal (420), transmitting a group owner negotiation confirmation frame indicating that the wireless terminal (410) is determined as a group owner to the external terminal (420) by the wireless terminal (410); and
when the first group owner intent value transmitted from the wireless terminal (410) is less than the second group owner intent value received from the external terminal (420), allocating (707) an IP address received from the wireless terminal (410) during execution of the discovery step as an IP address of the wireless terminal (410).

7. The method of any preceding claim, wherein transmitting the IP address comprises transmitting (603) a group owner negotiation confirmation frame indicating that the wireless terminal (610) is determined as a group owner including the IP address to an external terminal (620) determined as the GC when the wireless terminal (610) is determined as the group owner.

8. The method of any preceding claim, further comprising:

receiving (1301) a provision discovery request frame from a third external terminal (1320) after the wireless terminal (1310) is determined as the group owner; and
transmitting (1302) a provision discovery response frame including an IP address to the third external terminal (1320) by the wireless terminal (1310) in response to reception (1301) of the provision discovery request frame.

9. The method of any preceding claim, wherein the IP address includes a private IP address selected from a private IP address list stored in the wireless terminal.

10. An apparatus (1400) for allocating an Internet Protocol, IP, address to a group client, GC, the apparatus forming part of a wireless terminal (410, 510, 610, 1310) capable of performing peer-to-peer, P2P, communication according to the Wi-Fi Alliance Wi-Fi P2P Specification, the apparatus comprising:

a Wi-Fi module (1451) configured to support wireless communication based on an IP address, and perform a function of an access point

or a station in the P2P communication; and
a controller (1460) configured to control the Wi-Fi module (1451) to transmit a frame for discovering at least one external terminal (420, 520, 620, 1320), capable of performing the P2P communication and initiating a connection with the at least one discovered external terminal (420, 520, 620, 1320), and a frame for negotiating and determining with the external terminal (420, 520, 620, 1320) which of the terminal and the external terminal becomes a group owner, GO, performing a function of an access point and which becomes the GC performing a function of a station in a P2P group,
wherein the controller (1460) is configured to complete the connection, and control the Wi-Fi module (1451) to transmit or receive an IP address to be allocated to the group client to or from the external terminal (420, 520, 620, 1320) during one of the discovering and the negotiating.

11. The apparatus of claim 10, wherein the controller (1460) is configured to select a private IP address to be transmitted from a private IP address list, and control the Wi-Fi module (1451) to transmit the selected private IP address to the external terminal (420, 520, 620, 1320).

12. The apparatus of claim 11, wherein the controller (1460) is configured to allocate a private IP address received from the external terminal (420, 520, 620, 1320) as an IP address of the wireless terminal (410, 510, 610, 1310), and operate the Wi-Fi module (1451) as the GC when the wireless terminal (410, 510, 610, 1310) is determined as the GC as the negotiation result.

13. The apparatus of claim 12, wherein the controller (1460) is configured to operate the Wi-Fi module (1451) as the group owner when the wireless terminal (410, 510, 610, 1310) is determined as the group owner as the negotiation result.

14. The apparatus of claim 13, wherein the controller (1460) is configured to:

control the Wi-Fi module (1451) such that the wireless terminal (410, 510, 610, 1310) exchanges a frame including a first group owner intent value indicating intention of the P2P device becoming the group owner and the IP address with the external terminal (420, 520, 620, 1320),
determine the wireless terminal (410, 510, 610, 1310) as the group owner when the first group owner intent value transmitted from the wireless terminal (410, 510, 610, 1310) is greater than a second group owner intent value received from the external terminal (420, 520, 620, 1320),
control the Wi-Fi module (1451) to transmit a group owner negotiation confirmation frame indicating that the wireless terminal (410, 510, 610, 1310) is determined as the group owner to the external terminal (420, 520, 620, 1320), and allocate an IP address received from the external terminal (420, 520, 620, 1320) as an IP address of the wireless terminal (410, 510, 610, 1310) when the first group owner intent value is less than the second group owner intent value.

15. The apparatus of claim 14, wherein the controller (1460) is configured to:

select one group owner intent value from a preset group owner intent range and selects one private IP address from a private IP address list, and
control the Wi-Fi module (1451) to transmit a group owner negotiation request frame including the selected group owner intent value and the one selected private IP address to the external terminal (420, 520, 620, 1320).

16. The apparatus of claim 13, 14 or 15, wherein the controller (1460) is configured to:

select one private IP address from a private IP address list,
control the Wi-Fi module (1451) to transmit a provision discovery request frame including the one selected private IP address to the external terminal (420, 520, 620, 1320), and
control the Wi-Fi module (1451) to receive a provision discovery response frame from the external terminal (420, 520, 620, 1320), wherein the provision discovery response frame is a frame including a private IP address which the external terminal (420, 520, 620, 1320) transmits in response to the provision discovery request frame.

17. The apparatus of claim 16, wherein the controller (1460) is configured to:

control the Wi-Fi module (1451) to exchange a frame including a group owner intent value indicating intention of the wireless terminal (410, 510, 610, 1310) becoming the group owner as a numeric value with the external terminal (420, 520, 620, 1320),
determine the wireless terminal (410, 510, 610, 1310) as a group owner when the first group owner intent value transmitted from the wireless terminal (410, 510, 610, 1310) is greater than the second group owner intent value received

from the external terminal (420, 520, 620, 1320), and

allocate an IP address received from the wireless terminal (410, 510, 610, 1310) as an IP address of the wireless terminal (410, 510, 610, 1310) when the first group owner intent value transmitted from the wireless terminal (410, 510, 610, 1310) is less than the second group owner intent value received from the external terminal (420, 520, 620, 1320).

18. The apparatus of any of claims 13 to 17, wherein the controller (1460) is configured to control the Wi-Fi module (1451) to transmit a group owner negotiation confirmation frame indicating that the wireless terminal (410, 510, 610, 1310) is determined as a group owner including the IP address to an external terminal (420, 520, 620, 1320) determined as the GC when the wireless terminal (410, 510, 610, 1310) is determined as the group owner.

19. The apparatus of any of claims 13 to 18, wherein the controller (1460) is configured to control the Wi-Fi module (1451) to transmit a provision discovery response frame including an IP address to the third external terminal (1320) when receiving a provision discovery request frame from a third external terminal (1320) after the wireless terminal (1310) is determined as the group owner.

Patentansprüche

1. Verfahren zum Zuweisen einer Internetprotokoll- IP, Adresse zu einem Gruppen-Client, GC, wobei das Verfahren durch ein drahtloses Endgerät (410, 510, 610, 1310) ausgeführt wird, das fähig ist, eine Peer-to-Peer-Datenübertragung gemäß der Wi-Fi-Alliance-Spezifikation Wi-Fi P2P auszuführen, wobei das Verfahren aufweist:

ein Entdecken (210) von mindestens einem externen Endgerät (420, 520, 620, 1320), das fähig ist, die P2P-Datenübertragung auszuführen und eine Verbindung mit dem mindestens einen entdeckten externen Endgerät (420, 520, 620, 1320) zu initiieren;

ein Verhandeln (220) und ein Bestimmen mit dem externen Endgerät (420, 520, 620, 1320), welches von dem Endgerät und dem externen Endgerät ein Gruppeneigentümer, GO, wird, der eine Funktion eines Zugangspunkts ausführt, und der zum GC wird, der eine Funktion einer Station in einer P2P-Gruppe ausführt;

und ein Abschließen der Verbindung, wobei entweder das Entdecken (210) oder das Verhandeln (220) ein Übertragen oder ein Empfangen einer IP-Adresse enthält, die zu dem Gruppen-Client oder von dem externen Endgerät (420, 520, 620, 1320) zugewiesen werden soll.

2. Verfahren nach Anspruch 1, wobei das Verhandeln (220) aufweist:

ein Austauschen (501, 502) eines Frame, der einen ersten Gruppeneigentümer-Absichtswert, der die Absicht des drahtlosen Endgeräts (510), angibt, der Gruppeneigentümer zu werden, und die IP-Adresse enthält, mit dem externen Endgerät (520) durch das drahtlose Endgerät (510);

ein Übertragen (503) eines Gruppeneigentümer-Verhandlungsbestätigungs-Frame, der angibt, dass das drahtlose Endgerät (510) als ein Gruppeneigentümer durch das drahtlose Endgerät (510) bestimmt wird, wenn der erste Gruppeneigentümer-Absichtswert, der von dem drahtlosen Endgerät (510) übertragen wird, größer als ein zweiter Gruppeneigentümer-Absichtswert ist, der von dem externen Endgerät (520) empfangen wird;

und ein Zuweisen einer IP-Adresse von dem externen Endgerät (520) als eine IP-Adresse des drahtlosen Endgeräts (510) durch das drahtlose Endgerät (510), wenn der erste Gruppeneigentümer-Absichtswert, der von dem drahtlosen Endgerät (510) übertragen wird, kleiner als der zweite Gruppeneigentümer-Absichtswert ist.

3. Verfahren nach Anspruch 2, wobei der Frame einen Gruppeneigentümer-Verhandlungsanforderungs-Frame oder einen Gruppeneigentümer-Verhandlungsantwort-Frame enthält.

4. Verfahren nach Anspruch 2 oder 3, wobei ein Austauschen des Frame aufweist:

ein Auswählen (701) eines Gruppeneigentümer-Absichtswerts aus dem voreingestellten Gruppeneigentümer-Absichtsbereich durch das drahtlose Endgerät (410);

ein Auswählen (701) einer privaten IP-Adresse aus einer Liste von privaten IP-Adressen durch das drahtlose Endgerät (410);

ein Übertragen (702) des Gruppeneigentümer-Verhandlungsanforderungs-Frame mit dem ausgewählten Gruppeneigentümer-Absichtswert und der einen ausgewählten privaten IP-Adresse zu dem externen Endgerät durch das drahtlose Endgerät (410);

und ein Empfangen (703) eines Gruppeneigentümer-Verhandlungsantwort-Frame von dem externen Endgerät (420) durch das drahtlose Endgerät (410), wobei der Gruppeneigentümer-Verhandlungsantwort-Frame ein Frame mit einem Gruppeneigentümer-Absichtswert und ei-

ner privaten IP-Adresse ist, den das externe Endgerät (420) in Reaktion auf den Gruppeneigentümer-Verhandlungsanforderungs-Frame überträgt.

5. Verfahren nach einem der vorhergehenden Ansprüche, wobei das Entdecken aufweist;
ein Auswählen einer privaten IP-Adresse aus einer Liste von privaten IP-Adressen durch das drahtlose Endgerät (410);
ein Übertragen (401) eines Bereitstellungs-Entdeckungsanforderungs-Frame mit der einen ausgewählten privaten IP-Adresse zu dem externen Endgerät (420) durch das drahtlose Endgerät (410);
und ein Empfangen (402) eines Bereitstellungs-Entdeckungsantwort-Frame von dem externen Endgerät (420) durch das drahtlose Endgerät (410), wobei der Bereitstellungs-Entdeckungsantwort-Frame ein Frame mit einer privaten IP-Adresse ist, den das externe Endgerät (420) in Reaktion auf den Bereitstellungs-Entdeckungsanforderungs-Frame überträgt.

6. Verfahren nach Anspruch 5, wobei das Verhandeln aufweist:

ein Austauschen (702, 703) eines Frame, der einen Gruppeneigentümer-Absichtswert enthält, der die Absicht des drahtlosen Endgeräts (410), der Gruppeneigentümer zu werden, als einen numerischen Wert angibt, mit dem externen Endgerät (420) durch das drahtlose Endgerät (410);
wenn der erste Gruppeneigentümer-Absichtswert, der von dem drahtlosen Endgerät (410) übertragen wird (702), größer als der zweite Gruppeneigentümer-Absichtswert ist, der von dem externen Endgerät (420) empfangen wird (703), ein Übertragen eines Gruppeneigentümer-Verhandlungsbestätigungs-Frame, der angibt, dass das drahtlose Endgerät (410) als ein Gruppeneigentümer durch das drahtlose Endgerät bestimmt wurde, zu dem externen Endgerät (420) durch das drahtlose Endgerät (410);
und wenn der erste Gruppeneigentümer-Absichtswert, der von dem drahtlosen Endgerät (410) übertragen wird, kleiner als der zweite Gruppeneigentümer-Absichtswert ist, der von dem externen Endgerät (420) empfangen wird, ein Zuweisen (707) einer IP-Adresse, die von dem drahtlosen Endgerät (410) während einer Ausführung des Entdeckungsschritts als eine IP-Adresse des drahtlosen Endgeräts (410) empfangen wird.

7. Verfahren nach einem der vorhergehenden Ansprüche, wobei ein Übertragen der IP-Adresse ein Übertragen (603) eines Gruppeneigentümer-Verhandlungsbestätigungs-Frame, der angibt, dass das drahtlose Endgerät (610) als ein Gruppeneigentümer bestimmt ist, mit der IP-Adresse zu einem externen Endgerät (620) aufweist, das als der GC bestimmt wird, wenn das drahtlose Endgerät (610) als der Gruppeneigentümer bestimmt wird.

8. Verfahren nach einem der vorhergehenden Ansprüche, ferner aufweisend:

ein Empfangen (1301) eines Bereitstellungs-Entdeckungsanforderungs-Frame von einem dritten externen Endgerät (1320), nachdem das drahtlose Endgerät (1310) als der Gruppeneigentümer bestimmt worden ist;
und ein Übertragen (1302) eines Bereitstellungs-Entdeckungsantwort-Frame mit einer IP-Adresse zu dem dritten externen Endgerät (1320) durch das drahtlose Endgerät (1310) in Reaktion auf den Empfang (1301) des Bereitstellungs-Entdeckungsanforderungs-Frame.

9. Verfahren nach einem der vorhergehenden Ansprüche, wobei die IP-Adresse eine private IP-Adresse enthält, die aus einer Liste von privaten IP-Adressen ausgewählt wird, die in dem drahtlosen Endgerät gespeichert ist.

10. Vorrichtung (1400) zum Zuweisen einer Internetprotokoll- IP, Adresse zu einem Gruppen-Client, GC, wobei die Vorrichtung einen Teil eines drahtlosen Endgeräts (410, 510, 610, 1310) bildet, das fähig ist, eine Peer-to-Peer-Datenübertragung gemäß der Wi-Fi-Alliance-Spezifikation Wi-Fi P2P auszuführen, wobei die Vorrichtung aufweist:

ein WLAN-Modul (1451), das konfiguriert ist, um eine drahtlose Datenübertragung auf Grundlage einer IP-Adresse zu unterstützen und eine Funktion eines Zugangspunkts oder einer Station in der P2P-Datenübertragung auszuführen.
und einen Controller (1460), der konfiguriert ist, um das WLAN-Modul (1451) zu steuern, einen Frame zum Entdecken von mindestens einem externen Endgerät (420, 520, 620, 1320), das fähig ist, die P2P-Datenübertragung auszuführen und eine Verbindung mit dem mindestens einen entdeckten externen Endgerät (420, 520, 620, 1320) zu initiieren, und einen Frame zum Verhandeln und Bestimmen mit dem externen Endgerät (420, 520, 620, 1320), welches von dem Endgerät und dem externen Endgerät ein Gruppeneigentümer, GO, wird, der eine Funktion eines Zugangspunkts ausführt und der zum GC wird, der eine Funktion einer Station in einer P2P-Gruppe ausführt, zu übertragen, wobei der Controller (1460) konfiguriert ist, um die Verbindung abzuschließen und das WLAN-Modul (1451) zu steuern, eine IP-Adresse zu übertra-

gen oder zu empfangen, die zu dem Gruppen-Client oder von dem externen Endgerät (420, 520, 620, 1320) entweder während des Entdeckens oder des Verhandelns zugewiesen werden soll.

11. Vorrichtung nach Anspruch 10, wobei der Controller (1460) konfiguriert ist, um eine zu übertragende private IP-Adresse aus einer Liste von privaten IP-Adressen auszuwählen und das WLAN-Modul (1451) zu steuern, die ausgewählte private IP-Adresse zu dem externen Endgerät (420, 520, 620, 1320) zu übertragen.

12. Vorrichtung nach Anspruch 11, wobei der Controller (1460) konfiguriert ist, eine private IP-Adresse, die von dem externen Endgerät (420, 520, 620, 1320) empfangen wird, als eine IP-Adresse des drahtlosen Endgeräts (410, 510, 610, 1310) zuzuweisen und das WLAN-Modul (1451) als den GC zu betreiben, wenn das drahtlose Endgerät (410, 510, 610, 1310) als Verhandlungsergebnis als der GC bestimmt wird.

13. Vorrichtung nach Anspruch 12, wobei der Controller (1460) konfiguriert ist, das WLAN-Modul (1451) als den Gruppeneigentümer zu betreiben, wenn das drahtlose Endgerät (410, 510, 610, 1310) als Verhandlungsergebnis als der Gruppeneigentümer bestimmt wird.

14. Vorrichtung nach Anspruch 13, wobei der Controller (1460) konfiguriert ist zu:
einem Steuern des WLAN-Moduls (1451), sodass das drahtlose Endgerät (410, 510, 610, 1310) einen Frame, der einen ersten Gruppeneigentümer-Absichtswert, der die Absicht der P2P-Einheit, der Gruppeneigentümer zu werden und die IP-Adresse enthält, mit dem externen Endgerät (420, 520, 620, 1320) austauscht, einem Bestimmen des drahtlosen Endgeräts (410, 510, 610, 1310) als den Gruppeneigentümer, wenn der erste Gruppeneigentümer-Absichtswert, der von dem drahtlosen Endgerät (410, 510, 610, 1310) übertragen wird, größer als ein zweiter Gruppeneigentümer-Absichtswert ist, der von dem externen Endgerät (420, 520, 620, 1320) empfangen wird, einem Steuern des WLAN-Moduls (1451), einen Gruppeneigentümer-Verhandlungsbestätigungs-Frame, der angibt, dass das drahtlose Endgerät (410, 510, 610, 1310) als der Gruppeneigentümer bestimmt ist, zu dem externen Endgerät (420, 520, 620, 1320) zu übertragen, und einem Zuweisen einer IP-Adresse, die von dem externen Endgerät (420, 520, 620, 1320) als eine IP-Adresse des drahtlosen Endgeräts (410, 510, 610, 1310) empfangen wird, wenn der erste Gruppeneigentümer-Absichtswert kleiner als der zweite Gruppeneigentümer-Absichtswert ist.

15. Vorrichtung nach Anspruch 14, wobei der Controller (1460) konfiguriert ist zu:
einem Auswählen eines Gruppeneigentümer-Absichtswerts aus einem voreingestellten Gruppeneigentümer-Absichtsbereich und einem Auswählen einer privaten IP-Adresse aus einer Liste mit privaten IP-Adressen, und einem Steuern des WLAN-Moduls (1451), um einen Gruppeneigentümer-Verhandlungsanforderungs-Frame mit dem ausgewählten Gruppeneigentümer-Absichtswert und der einen ausgewählten privaten IP-Adresse zu dem externen Endgerät (420, 520, 620, 1320) zu übertragen.

16. Vorrichtung nach Anspruch 13, 14 oder 15, wobei der Controller (1460) konfiguriert ist zu:

einem Auswählen einer privaten IP-Adresse aus einer Liste von privaten IP-Adressen,
einem Steuern des WLAN-Moduls (1451), einen Bereitstellungs-Entdeckungsanforderungs-Frame mit der einen ausgewählten privaten IP-Adresse zu dem externen Endgerät (420, 520, 620, 1320) zu übertragen, und
einem Steuern des WLAN-Moduls (1451), um einen Bereitstellungs-Entdeckungsantwort-Frame von dem externen Endgerät (420, 520, 620, 1320) zu empfangen, wobei der Bereitstellungs-Entdeckungsantwort-Frame ein Frame mit einer privaten IP-Adresse ist, der das externe Endgerät (420, 520, 620, 1320) in Reaktion auf den Bereitstellungs-Entdeckungsanforderungs-Frame überträgt.

17. Vorrichtung nach Anspruch 16, wobei der Controller (1460) konfiguriert ist zu:
einem Steuern des WLAN-Moduls (1451), um einen Frame, der einen Gruppeneigentümer-Absichtswert enthält, der die Absicht des drahtlosen Endgeräts (410, 510, 610, 1310), der Gruppeneigentümer zu werden, als einen numerischen Wert angibt, mit dem externen Endgerät (420, 520, 620, 1320) auszutauschen, einem Bestimmen des drahtlosen Endgeräts (410, 510, 610, 1310) als den Gruppeneigentümer, wenn der erste Gruppeneigentümer-Absichtswert, der von dem drahtlosen Endgerät (410, 510, 610, 1310) übertragen wird, größer als der zweite Gruppeneigentümer-Absichtswert ist, der von dem externen Endgerät (420, 520, 620, 1320) empfangen wird, und einem Zuweisen einer IP-Adresse, die von dem drahtlosen Endgerät (410, 510, 610, 1310) als eine IP-Adresse des drahtlosen Endgeräts (410, 510, 610, 1310) empfangen wird, wenn der erste Gruppeneigentümer-Absichtswert, der von dem drahtlosen Endgerät (410, 510, 610, 1310) übertragen wird, kleiner als der zweite Gruppeneigentümer-Absichtswert ist, der von dem externen Endgerät (420, 520, 620, 1320) empfangen wird.

18. Vorrichtung nach einem der Ansprüche 13 bis 17, wobei der Controller (1460) konfiguriert ist, um das WLAN-Modul (1451) zu steuern, einen Gruppeneigentümer-Verhandlungsbestätigungs-Frame, der angibt, dass das drahtlose Endgerät (410, 510, 610, 1310) als ein Gruppeneigentümer bestimmt ist, mit der IP-Adresse zu einem externen Endgerät (420, 520, 620, 1320) zu übertragen, das als der GC bestimmt wird, wenn das drahtlose Endgerät (410, 510, 610, 1310) als der Gruppeneigentümer bestimmt wird.

19. Vorrichtung nach einem der Ansprüche 13 bis 18, wobei der Controller (1460) konfiguriert ist, um das WLAN-Modul (1451) zu steuern, einen Bereitstellungs-Entdeckungsanforderungs-Frame mit einer IP-Adresse zu dem dritten externen Endgerät (1320) zu übertragen, wenn ein Bereitstellungs-Entdeckungsanforderungs-Frame von einem dritten externen Endgerät (1320) empfangen wird, nachdem das drahtlose Endgerät (1310) als der Gruppeneigentümer bestimmt worden ist.

Revendications

1. Méthode d'allocation d'une adresse de protocole internet (IP) à un client de groupe, GC, la méthode étant effectuée par un terminal sans fil (410, 510, 610, 1310) en mesure d'effectuer des communications pair à pair, P2P, conformément à la spécification Wi-Fi P2P de la WiFi Alliance, la méthode comprenant :

la découverte (210) d'au moins un terminal externe (420, 520, 620, 1320) en mesure d'effectuer des communications P2P, et d'établir une connexion avec l'au moins un terminal externe (420, 520, 620, 1320) découvert ;
la négociation (220) et la détermination, avec le terminal externe (420, 520, 620, 1320), de celui, parmi le terminal et le terminal externe, qui devient un chef de groupe, GO, exerçant une fonction de point d'accès et devenant le GC exerçant une fonction de station dans un groupe P2P ; et l'achèvement de la connexion, une de la découverte (210) et de la négociation (220) comprenant la transmission ou la réception d'une adresse IP à allouer au client de groupe au terminal externe (420, 520, 620, 1320) ou depuis celui-ci.

2. Méthode selon la revendication 1, la négociation (220) comprenant :

l'échange (501,502), par le terminal sans fil (510), d'une trame comprenant une première valeur d'intention du chef de groupe indiquant l'intention du terminal sans fil (510) de devenir le chef de groupe, et l'adresse IP avec le terminal externe (520) ;
la transmission (503), par le terminal sans fil (510), d'une trame de confirmation de la négociation de chef de groupe indiquant que le terminal sans fil (510) est déterminé comme étant le chef de groupe lorsque la première valeur d'intention de chef de groupe transmise par le terminal sans fil (510) est supérieure à la deuxième valeur d'intention de chef de groupe reçue du terminal externe (520) ; et
l'allocation, par le terminal sans fil (510), d'une adresse IP provenant du terminal externe (520) en tant qu'adresse IP du terminal sans fil (510) lorsque la première valeur d'intention de chef de groupe transmise depuis le terminal sans fil (510) est inférieure à la deuxième valeur d'intention de chef de groupe.

3. Méthode selon la revendication 2, la trame comprenant une trame de demande de négociation du chef de groupe ou une trame de réponse de négociation du chef de groupe.

4. Méthode selon la revendication 2 ou 3, l'échange de trame comprenant :

la sélection (701), par le terminal sans fil (410), d'une valeur d'intention de chef de groupe de la gamme préétablie d'intentions de chef de groupe ;
la sélection (701), par le terminal sans fil (410), d'une adresse IP privée dans une liste d'adresses IP privées ;
la transmission (702), par le terminal sans fil (410), au terminal externe, de la trame de demande de négociation du chef de groupe, comprenant la valeur d'intention de chef de groupe sélectionnée, et l'adresse IP privée sélectionnée ; et
la réception (703), par le terminal sans fil (410), du terminal externe (420), d'une trame de réponse de négociation du chef de groupe, la trame de réponse de négociation du chef de groupe étant une trame comprenant une valeur d'intention de chef de groupe et une adresse IP privée, que le terminal externe (420) transmet en réponse à la trame de demande de négociation du chef de groupe.

5. Méthode selon une quelconque des revendications précédentes, la découverte comprenant :

la sélection d'une adresse IP privée dans une liste d'adresses IP privées par le terminal sans fil (410) ;
la transmission (401), au terminal externe (420) par le terminal sans fil (410), d'une trame de

demande de découverte de fourniture comprenant l'adresse IP privée sélectionnée ; et
la réception (402), du terminal externe (420), par le terminal sans fil (410), d'une trame de réponse de découverte de fourniture, la trame de réponse de découverte de fourniture étant une trame comprenant une adresse IP privée que le terminal externe (420) transmet en réponse à la trame de réponse de découverte de fourniture.

6. Méthode selon la revendication 5, la négociation comprenant :

l'échange (702, 703), avec le terminal externe (420) par le terminal sans fil (410), d'une trame comprenant une valeur d'intention du chef de groupe indiquant l'intention du terminal sans fil (410) de devenir le chef de groupe, sous forme de valeur numérique ;
lorsque la première valeur d'intention du chef de groupe transmise (702) depuis le terminal sans fil (410) est supérieure à la deuxième valeur d'intention du chef de groupe reçue (703) du terminal externe (420), la transmission, par le terminal sans fil (410) au terminal externe (420), d'une trame de confirmation de la négociation de chef de groupe indiquant que le terminal sans fil (410) est déterminé comme étant le chef de groupe ; et
lorsque la première valeur d'intention de chef de groupe transmise depuis le terminal sans fil (410) est inférieure à la deuxième valeur d'intention de chef de groupe reçue du terminal externe (420), l'allocation (707) d'une adresse IP reçue du terminal sans fil (410) au cours de l'exécution de l'étape de découverte en tant qu'adresse IP du terminal sans fil (410).

7. Méthode selon une quelconque des revendications précédentes, la transmission de l'adresse IP comprenant la transmission (603) d'une trame de confirmation de négociation du chef de groupe indiquant que le terminal sans fil (610) est déterminé en tant que chef de groupe, y compris l'adresse IP, à un terminal externe (620) déterminé en tant que GC lorsque le terminal sans fil (610) est déterminé comme étant le chef de groupe.

8. Méthode selon une quelconque des revendications précédentes, comprenant en outre :

la réception (1301), d'un troisième terminal externe (1320), d'une trame de demande de découverte de fourniture après la détermination du terminal sans fil (1310) comme étant chef de groupe ; et
la transmission (1302), par le terminal sans fil (1310) au troisième terminal externe (1320), d'une trame de réponse de découverte de fourniture comprenant une adresse IP en réponse à la réception (1301) de la trame de demande de découverte de fourniture.

9. Méthode selon une quelconque des revendications précédentes, l'adresse IP comprenant une adresse IP privée sélectionnée parmi une liste d'adresses IP privées stockées dans le terminal sans fil.

10. Appareil (1400) pour l'allocation d'une adresse de protocole internet, IP, à un client de groupe, GC, l'appareil faisant partie d'un terminal sans fil (410, 510, 610, 1310) en mesure d'effectuer des communications pair à pair, P2P, conformément à la spécification Wi-Fi P2P de la WiFi Alliance, l'appareil comprenant :

un module Wi-Fi (1451) configuré pour supporter des communications sans fil basées sur une adresse IP, et exercer une fonction de point d'accès ou de station dans les communications P2P ; et
un contrôleur (1460) configuré pour commander au module Wi-Fi (1451) de transmettre une trame pour la découverte d'au moins un terminal externe (420, 520, 620, 1320) en mesure d'effectuer les communications P2P et d'établir une connexion avec l'au moins un terminal externe (420, 520, 620, 1320) découvert, et une trame pour la négociation et la détermination, avec le terminal externe (420, 520, 620, 1320), de celui, parmi le terminal et le terminal externe, qui devient chef de groupe, GO, exerçant une fonction de point d'accès, et celui qui devient GC exerçant une fonction de station dans un groupe P2P, le contrôleur (1460) étant configuré pour effectuer une connexion, et commander au module Wi-Fi (1451) de transmettre ou recevoir une adresse IP à allouer au client de groupe au terminal externe (420, 520, 620, 1320), ou de celui-ci, au cours d'une de la découverte et de la négociation.

11. Appareil selon la revendication 10, le contrôleur (1460) étant configuré pour sélectionner une adresse IP privée à transmettre depuis une liste d'adresses IP privées, et commander au module Wi-Fi (1451) de transmettre l'adresse IP privée sélectionnée au terminal externe (420, 520, 620, 1320).

12. Appareil selon la revendication 11, le contrôleur (1460) étant configuré pour allouer une adresse IP privée reçue du terminal externe (420, 520, 620, 1320) en tant qu'adresse IP du terminal sans fil (410, 510, 610, 1310), et utiliser le module Wi-Fi (1451) en tant que GC lorsque le terminal sans fil (410, 510, 610, 1310) est déterminé comme étant le GC à l'is-

sue de la négociation.

13. Appareil selon la revendication 12, le contrôleur (1460) étant configuré pour utiliser le module Wi-Fi (1451) en tant que chef de groupe lorsque le terminal sans fil (410, 510, 610, 1310) est déterminé comme étant le chef de groupe à l'issue de la négociation.

14. Appareil selon la revendication 13, le contrôleur (1460) étant configuré pour :
contrôler le module Wi-Fi (1451) afin que le terminal sans fil (410, 510, 610, 1310) échange une trame comprenant une première valeur d'intention du chef de groupe indiquant l'intention du dispositif P2P de devenir le chef de groupe, et l'adresse IP avec le terminal externe (420, 520, 620, 1320), déterminer le terminal sans fil (410, 510, 610, 1310) comme étant le chef de groupe lorsque la première valeur d'intention de chef de groupe transmise par le terminal sans fil (410, 510, 610, 1310) est supérieure à une deuxième valeur d'intention de chef de groupe reçue du terminal externe (420, 520, 620, 1320), commander au module Wi-Fi (1451) de transmettre au terminal externe (420, 520, 620, 1320) une trame de confirmation de négociation du chef de groupe indiquant que le terminal sans fil (410, 510, 610, 1310) a été déterminé comme étant le chef de groupe, et allouer une adresse IP reçue du terminal externe (420, 520, 620, 1320) en tant qu'adresse IP du terminal sans fil (410, 510, 610, 1310), lorsque la première valeur d'intention de chef de groupe est inférieure à la deuxième valeur d'intention de chef de groupe.

15. Appareil selon la revendication 14, le contrôleur (1460) étant configuré pour :
sélectionner une valeur d'intention de chef de groupe dans une gamme préétablie d'intention de chef de groupe, et sélectionner une adresse IP privée dans une liste d'adresses IP privées, et commander au module Wi-Fi (1451) de transmettre au terminal externe (420, 520, 620, 1320) une trame de demande de négociation de chef de groupe comprenant la valeur d'intention de chef de groupe sélectionnée et l'adresse IP privée sélectionnée.

16. Appareil selon la revendication 13, 14 ou 15, le contrôleur (1460) étant configuré pour :
sélectionner une adresse IP privée dans une liste d'adresses IP privées, commander au module Wi-Fi (1451) de transmettre, au terminal externe (420, 520, 620, 1320), une trame de demande de découverte de fourniture comprenant l'adresse IP privée sélectionnée, et commander au module Wi-Fi (1451) de recevoir, du terminal externe (420, 520, 620, 1320), une trame de réponse de découverte de fourniture, la trame de réponse de découverte de fourniture étant une trame comprenant une adresse IP privée que le terminal externe (420, 520, 620, 1320) transmet en réponse à la trame de demande de découverte de fourniture.

17. Appareil selon la revendication 16, le contrôleur (1460) étant configuré pour :
commander au module Wi-Fi (1451) d'échanger une trame comprenant une valeur d'intention du chef de groupe indiquant l'intention du terminal sans fil (410, 510, 610, 1310) de devenir le chef de groupe, sous forme de valeur numérique avec le terminal externe (420, 520, 620, 1320), établir le terminal sans fil (410, 510, 610, 1310) en tant que chef de groupe lorsque la première valeur d'intention du chef de groupe transmise depuis le terminal sans fil (410, 510, 610, 1310) est supérieure à la deuxième valeur d'intention du chef de groupe reçue du terminal externe (420, 520, 620, 1320), et allouer une adresse IP reçue du terminal sans fil (410, 510, 610, 1310) en tant qu'adresse IP du terminal sans fil (410, 510, 610, 1310) lorsque la première valeur d'intention du chef de groupe transmise depuis le terminal sans fil (410, 510, 610, 1310) est inférieure à la deuxième valeur d'intention du chef de groupe reçue du terminal externe (420, 520, 620, 1320).

18. Appareil selon une quelconque des revendications 13 à 17, le contrôleur (1460) étant configuré pour commander au module Wi-Fi (1451) de transmettre une trame de confirmation de négociation de chef de groupe indiquant que le terminal sans fil (410, 510, 610, 1310) est déterminé comme étant chef de groupe, y compris l'adresse IP à un terminal externe (420, 520, 620, 1320) déterminé comme GC lorsque le terminal sans fil (410, 510, 610, 1310) est déterminé comme étant le chef de groupe.

19. Appareil selon une quelconque des revendications 13 à 18, le contrôleur (1460) étant configuré pour commander au module Wi-Fi (1451) de transmettre une trame de réponse de découverte de fourniture, comprenant une adresse IP, au troisième terminal externe (1320) lors de la réception, d'un troisième terminal externe (1320), d'une trame de demande de découverte de fourniture après la détermination du terminal sans fil (1310) en tant que chef de groupe.

FIG. 1

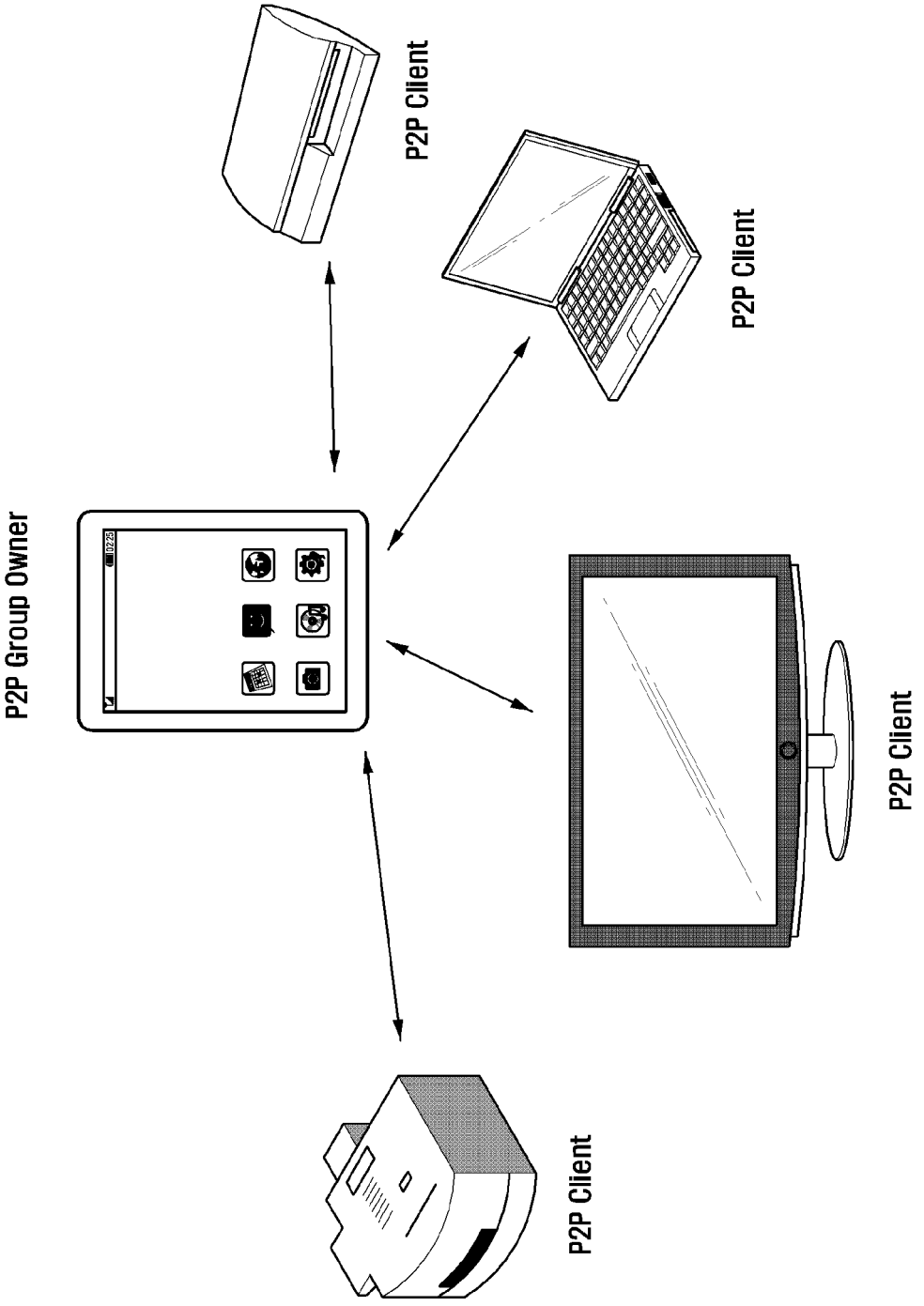


FIG. 2

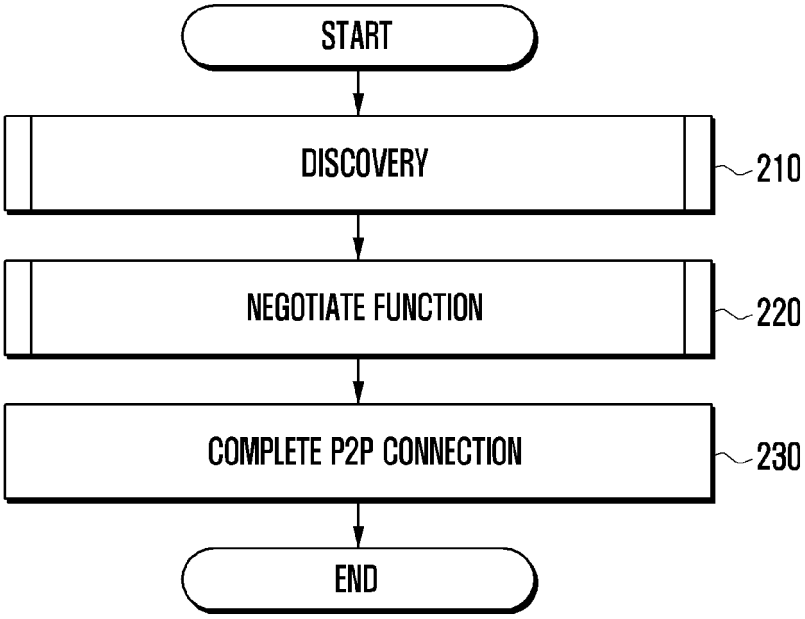

START
DISCOVERY
210
NEGOTIATE FUNCTION
220
COMPLETE P2P CONNECTION
230
END

FIG. 3

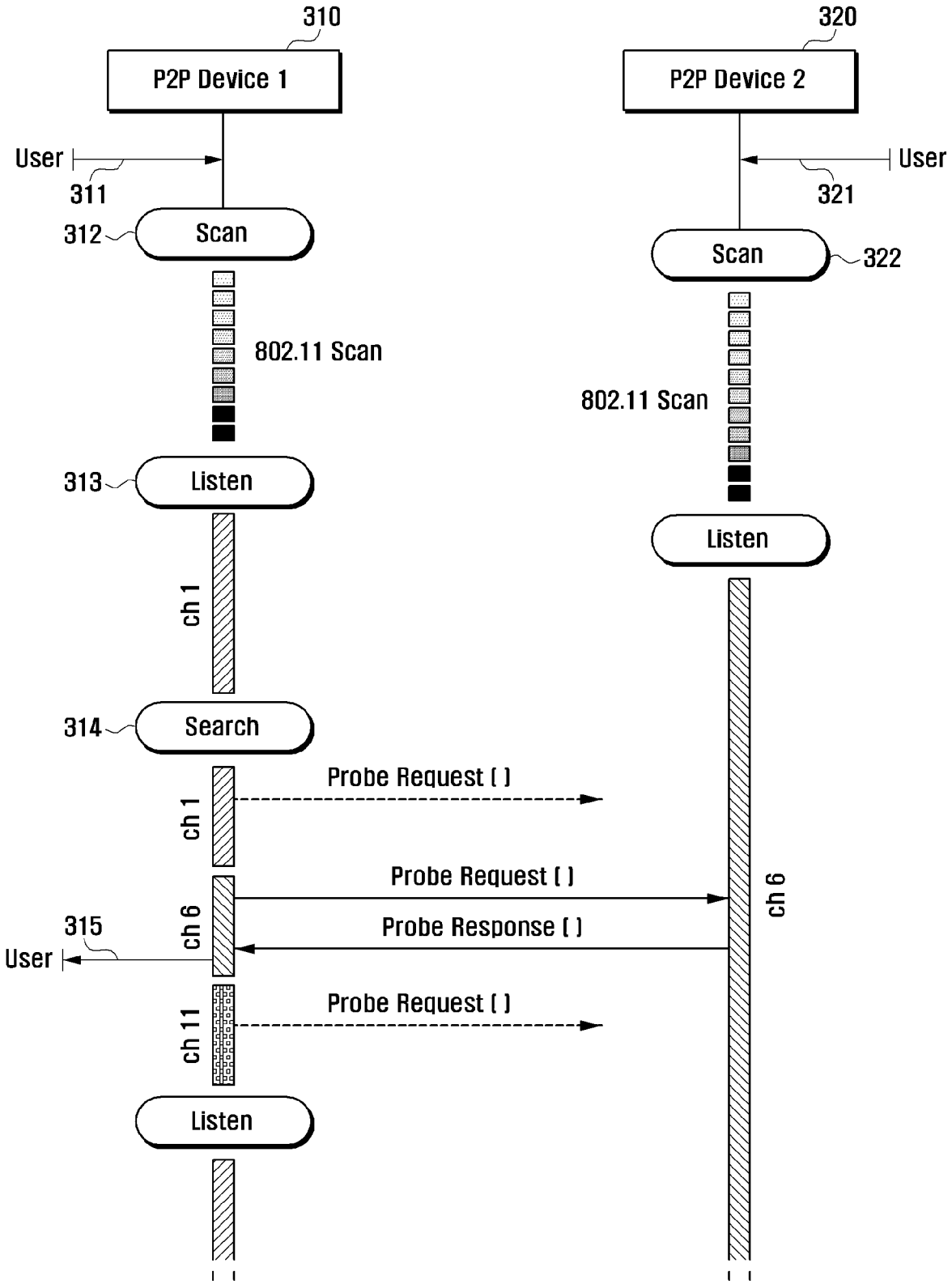

310
P2P Device 1
320
P2P Device 2
User
311
User
321
312
Scan
Scan
322
802.11 Scan
802.11 Scan
313
Listen
Listen
ch 1
314
Search
ch 1
Probe Request [ ]
Probe Request [ ]
ch 6
ch 6
315
User
Probe Response [ ]
ch 11
Probe Request [ ]
Listen

FIG. 4

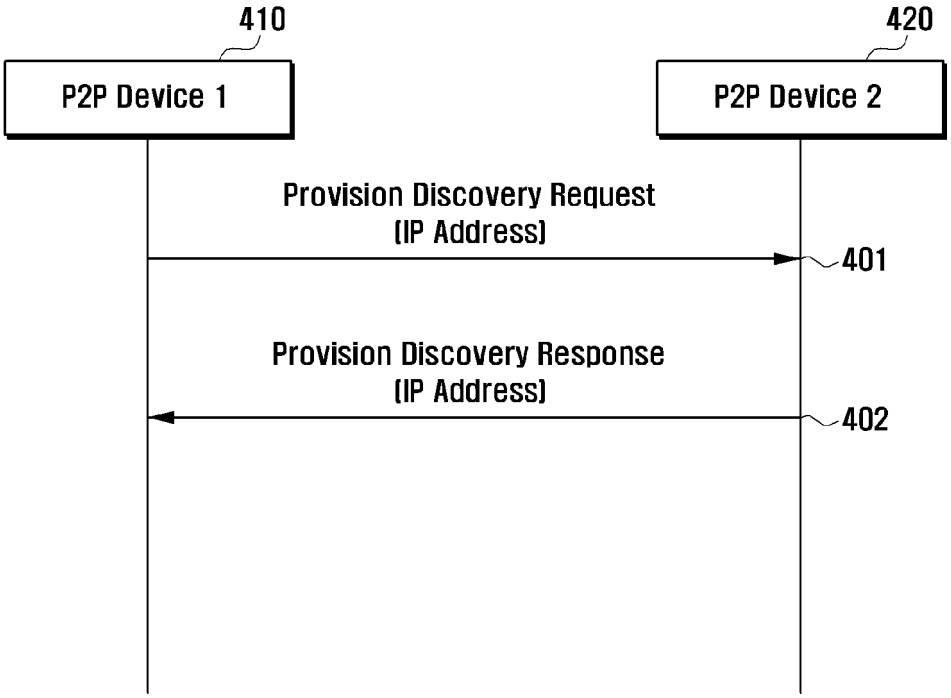

410
420
P2P Device 1
P2P Device 2
Provision Discovery Request
(IP Address)
401
Provision Discovery Response
(IP Address)
402

FIG. 5

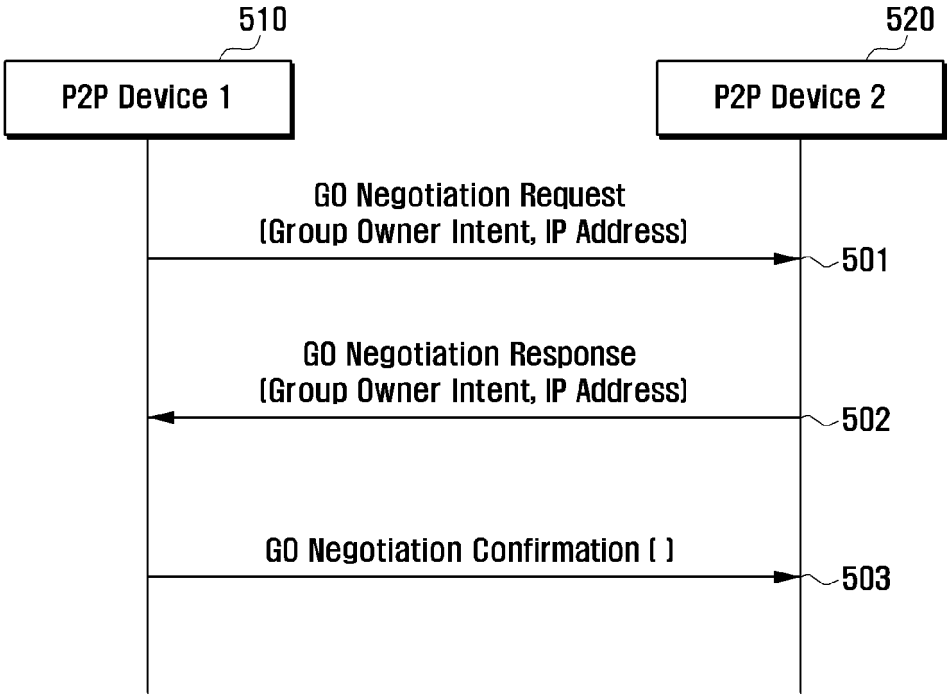

510
520
P2P Device 1
P2P Device 2
GO Negotiation Request
(Group Owner Intent, IP Address)
501
GO Negotiation Response
(Group Owner Intent, IP Address)
502
GO Negotiation Confirmation ( )
503

FIG. 6

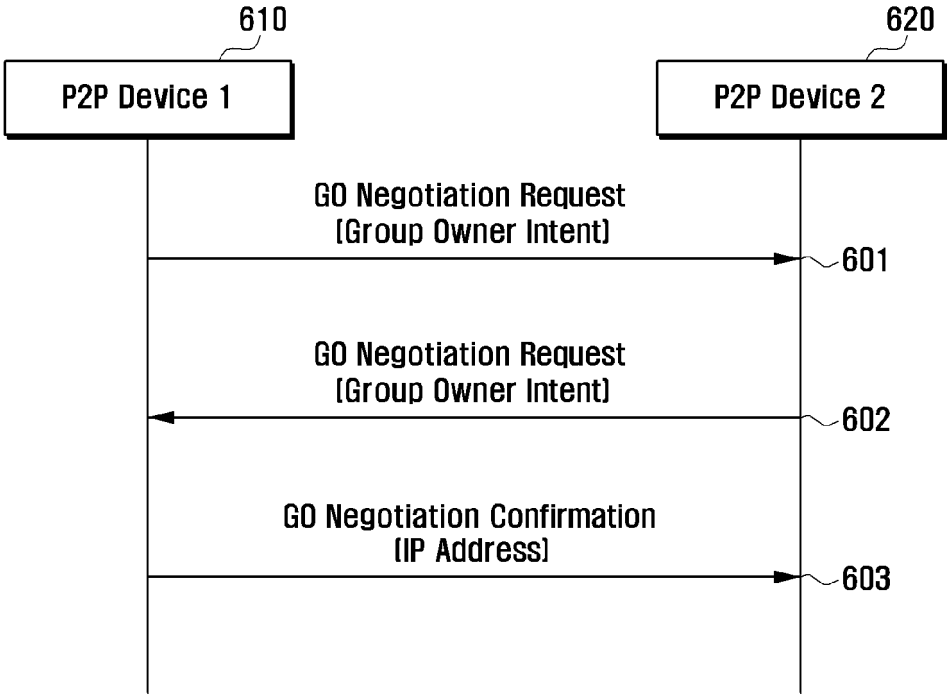

610
620
P2P Device 1
P2P Device 2
GO Negotiation Request
(Group Owner Intent)
601
GO Negotiation Request
(Group Owner Intent)
602
GO Negotiation Confirmation
(IP Address)
603

FIG. 7

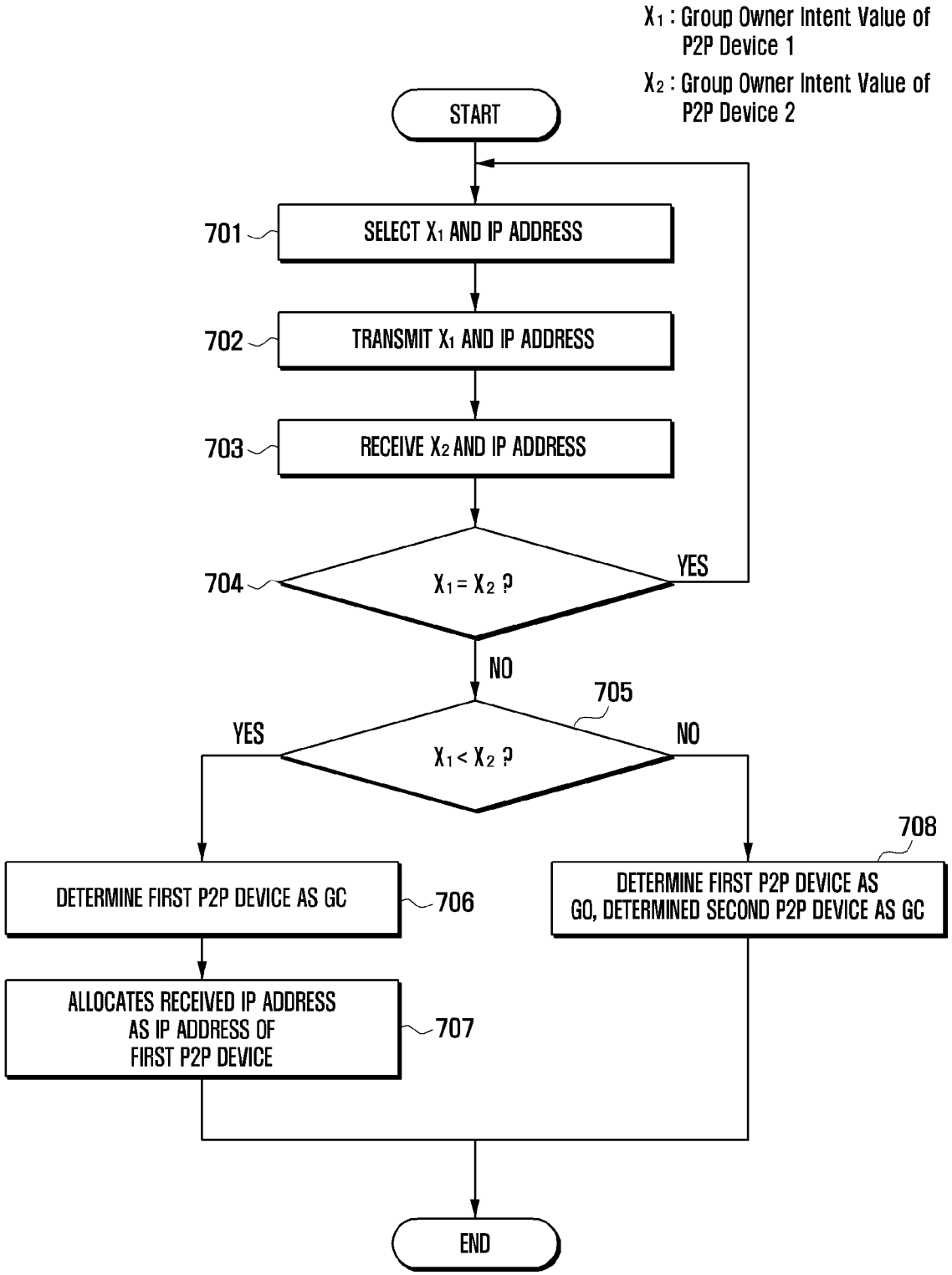

X1 : Group Owner Intent Value of P2P Device 1
X2 : Group Owner Intent Value of P2P Device 2
START
701
SELECT X1 AND IP ADDRESS
702
TRANSMIT X1 AND IP ADDRESS
703
RECEIVE X2 AND IP ADDRESS
704
X1 = X2 ?
YES
NO
705
X1 < X2 ?
YES
NO
706
DETERMINE FIRST P2P DEVICE AS GC
707
ALLOCATES RECEIVED IP ADDRESS AS IP ADDRESS OF FIRST P2P DEVICE
708
DETERMINE FIRST P2P DEVICE AS GO, DETERMINED SECOND P2P DEVICE AS GC
END

FIG. 8

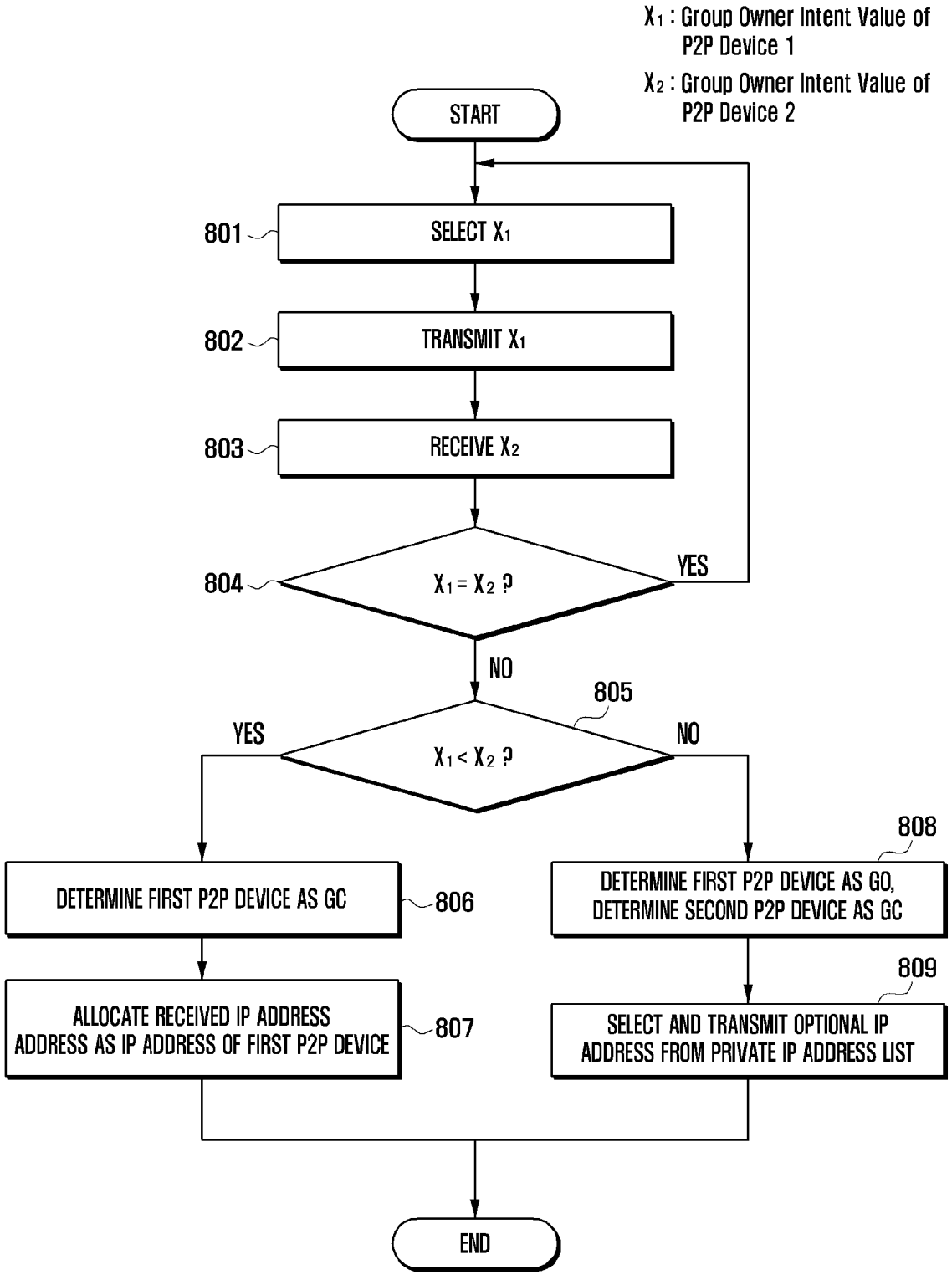

X1 : Group Owner Intent Value of P2P Device 1
X2 : Group Owner Intent Value of P2P Device 2
START
801
SELECT X1
802
TRANSMIT X1
803
RECEIVE X2
804
X1 = X2 ?
YES
NO
805
X1 < X2 ?
YES
NO
DETERMINE FIRST P2P DEVICE AS GC
806
ALLOCATE RECEIVED IP ADDRESS ADDRESS AS IP ADDRESS OF FIRST P2P DEVICE
807
808
DETERMINE FIRST P2P DEVICE AS GO, DETERMINE SECOND P2P DEVICE AS GC
809
SELECT AND TRANSMIT OPTIONAL IP ADDRESS FROM PRIVATE IP ADDRESS LIST
END

FIG. 9

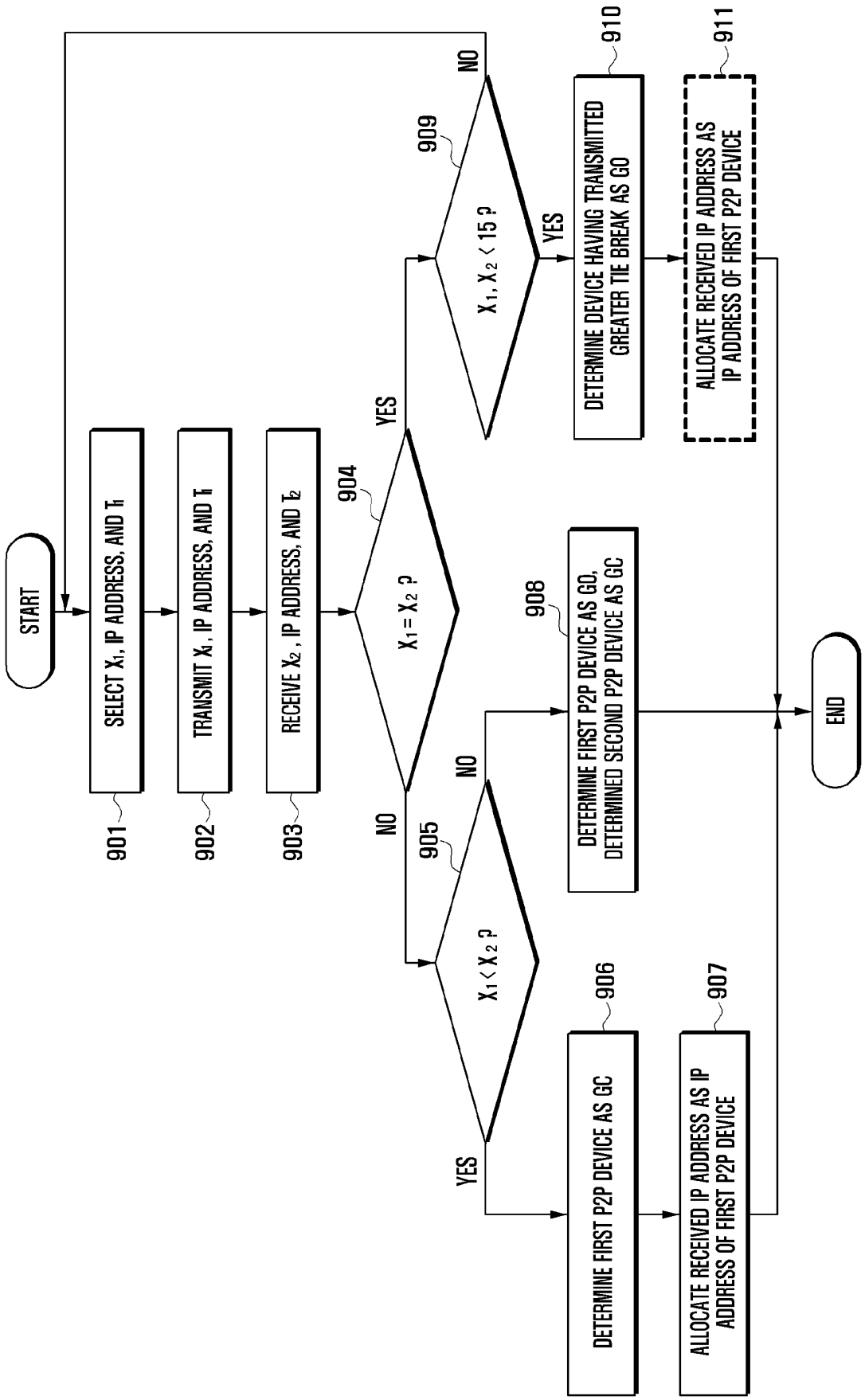

START
SELECT X1, IP ADDRESS, AND T1
TRANSMIT X1, IP ADDRESS, AND T1
RECEIVE X2, IP ADDRESS, AND T2
X1 = X2 ?
X1 < X2 ?
X1, X2 < 15 ?
DETERMINE FIRST P2P DEVICE AS GC
DETERMINE FIRST P2P DEVICE AS GO, DETERMINED SECOND P2P DEVICE AS GC
DETERMINE DEVICE HAVING TRANSMITTED GREATER TIE BREAK AS GO
ALLOCATE RECEIVED IP ADDRESS AS IP ADDRESS OF FIRST P2P DEVICE
ALLOCATE RECEIVED IP ADDRESS AS IP ADDRESS OF FIRST P2P DEVICE
END
901
902
903
904
905
906
907
908
909
910
911
YES
NO

FIG. 10

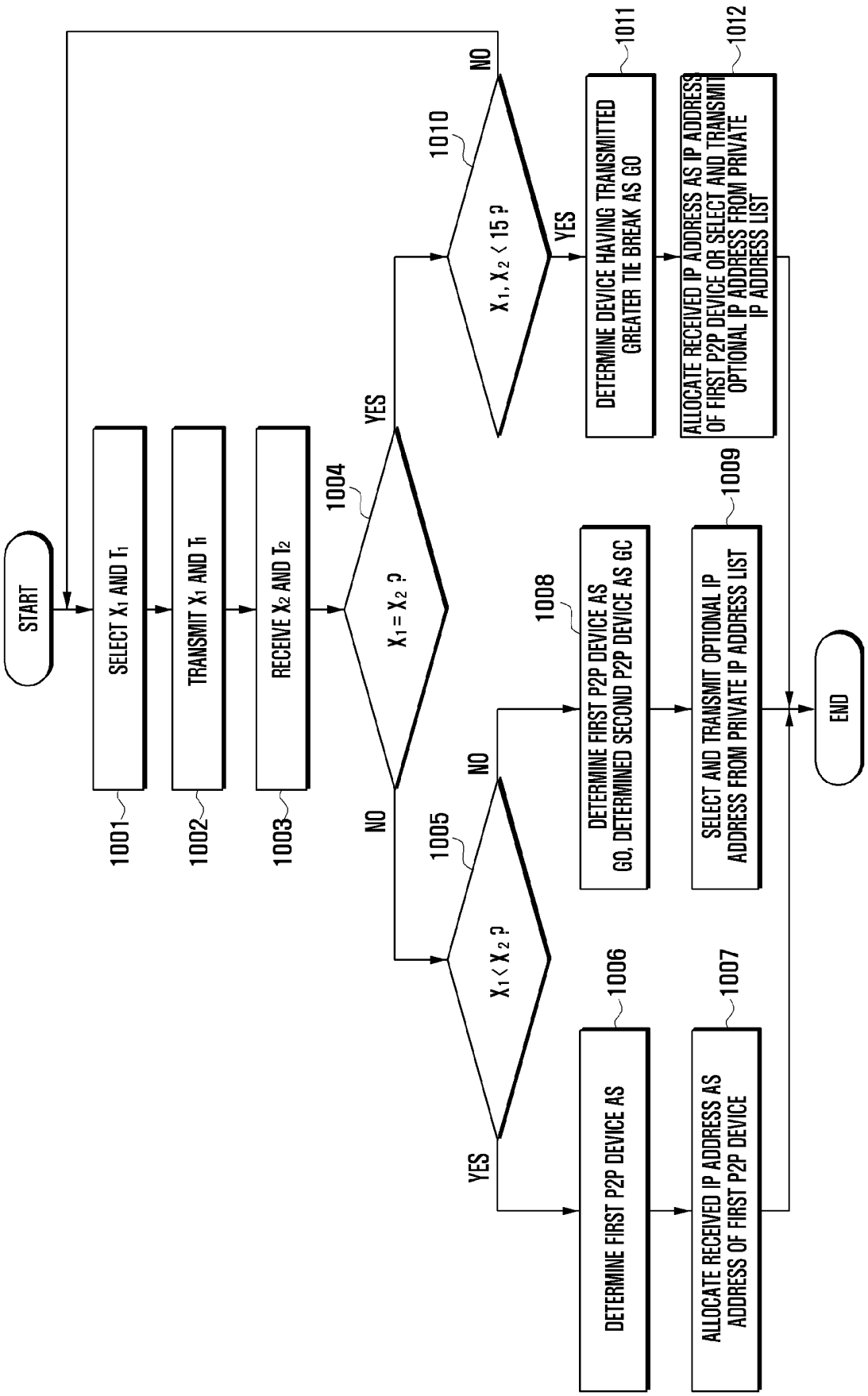

START
SELECT X1 AND T1
TRANSMIT X1 AND T1
RECEIVE X2 AND T2
X1 = X2 ?
X1 < X2 ?
X1, X2 < 15 ?
DETERMINE FIRST P2P DEVICE AS GO, DETERMINED SECOND P2P DEVICE AS GC
SELECT AND TRANSMIT OPTIONAL IP ADDRESS FROM PRIVATE IP ADDRESS LIST
DETERMINE FIRST P2P DEVICE AS
ALLOCATE RECEIVED IP ADDRESS AS ADDRESS OF FIRST P2P DEVICE
DETERMINE DEVICE HAVING TRANSMITTED GREATER TIE BREAK AS GO
ALLOCATE RECEIVED IP ADDRESS AS IP ADDRESS OF FIRST P2P DEVICE OR SELECT AND TRANSMIT OPTIONAL IP ADDRESS FROM PRIVATE IP ADDRESS LIST
END
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
1011
1012
YES
NO

FIG. 11

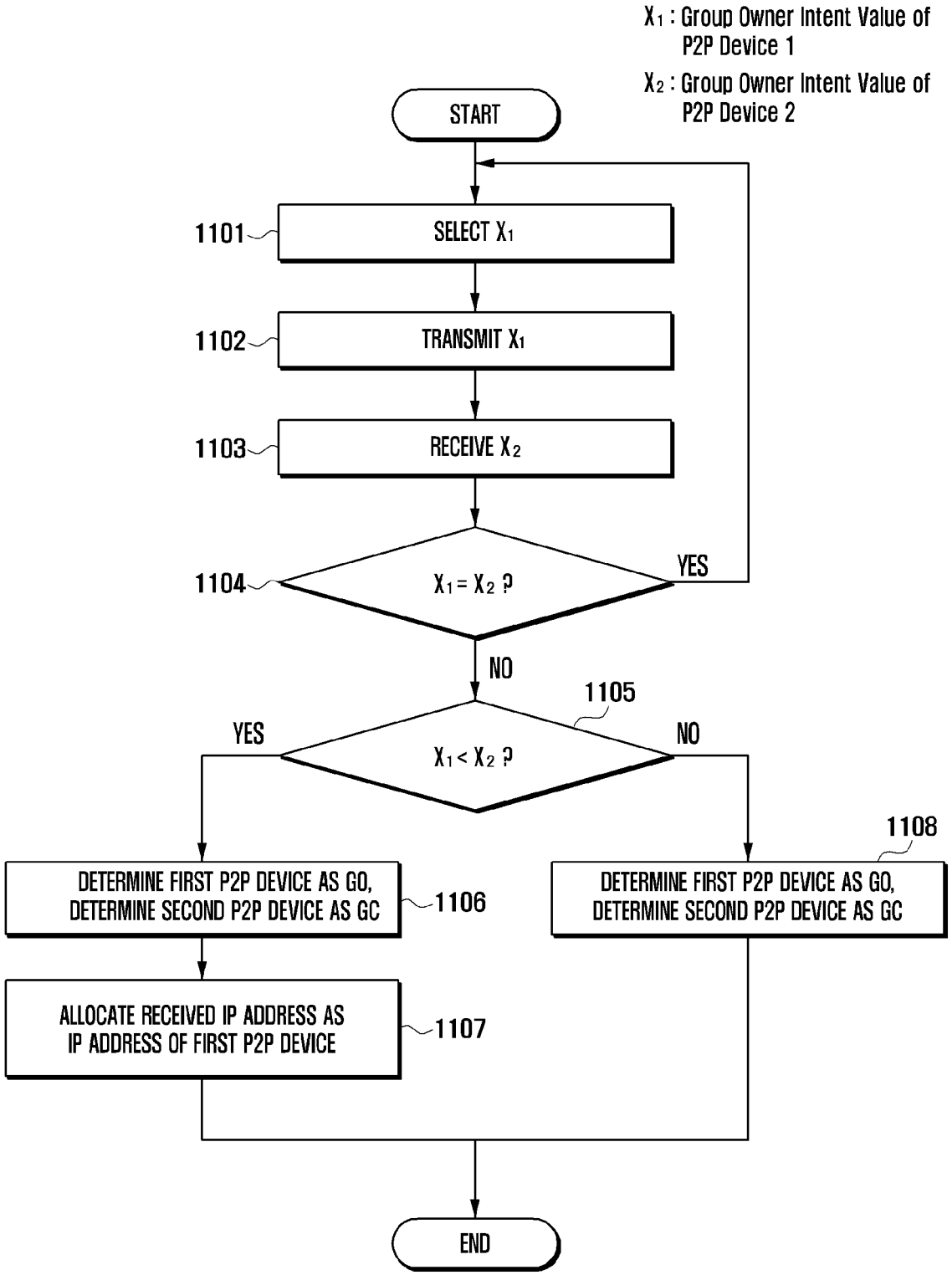

X1 : Group Owner Intent Value of P2P Device 1
X2 : Group Owner Intent Value of P2P Device 2
START
1101
SELECT X1
1102
TRANSMIT X1
1103
RECEIVE X2
1104
X1 = X2 ?
YES
NO
1105
X1 < X2 ?
YES
NO
1106
DETERMINE FIRST P2P DEVICE AS GO, DETERMINE SECOND P2P DEVICE AS GC
1107
ALLOCATE RECEIVED IP ADDRESS AS IP ADDRESS OF FIRST P2P DEVICE
1108
DETERMINE FIRST P2P DEVICE AS GO, DETERMINE SECOND P2P DEVICE AS GC
END

FIG. 12

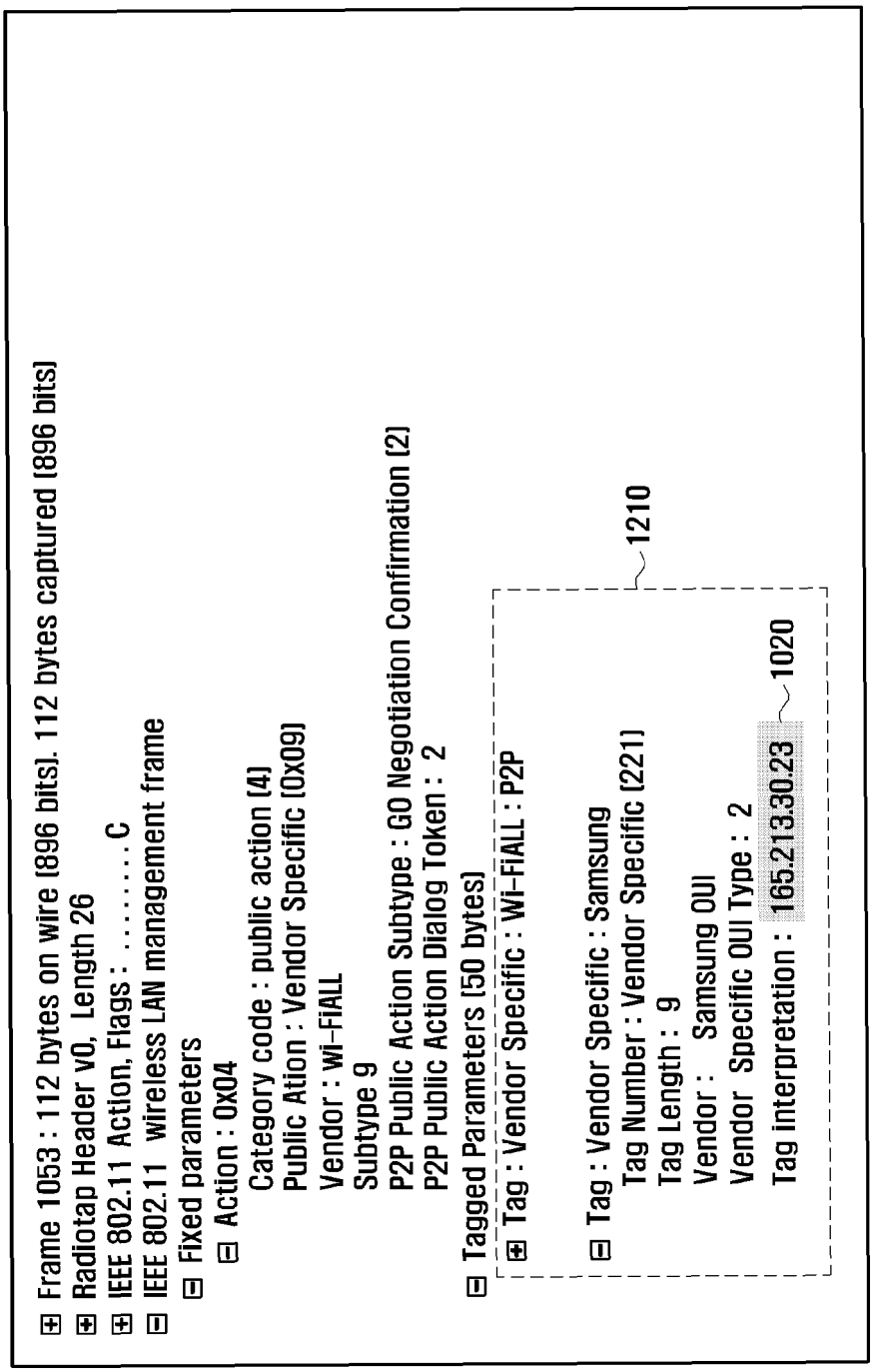

Frame 1053 : 112 bytes on wire (896 bits). 112 bytes captured (896 bits)
Radiotap Header v0, Length 26
IEEE 802.11 Action, Flags : C
IEEE 802.11 wireless LAN management frame
Fixed parameters
Action : 0x04
Category code : public action (4)
Public Ation : Vendor Specific (0x09)
Vendor : Wi-FiALL
Subtype 9
P2P Public Action Subtype : GO Negotiation Confirmation (2)
P2P Public Action Dialog Token : 2
Tagged Parameters (50 bytes)
Tag : Vendor Specific : Wi-FiALL : P2P
Tag : Vendor Specific : Samsung
Tag Number : Vendor Specific (221)
Tag Length : 9
Vendor : Samsung OUI
Vendor Specific OUI Type : 2
Tag interpretation : 165.213.30.23
1210
1020

FIG. 13

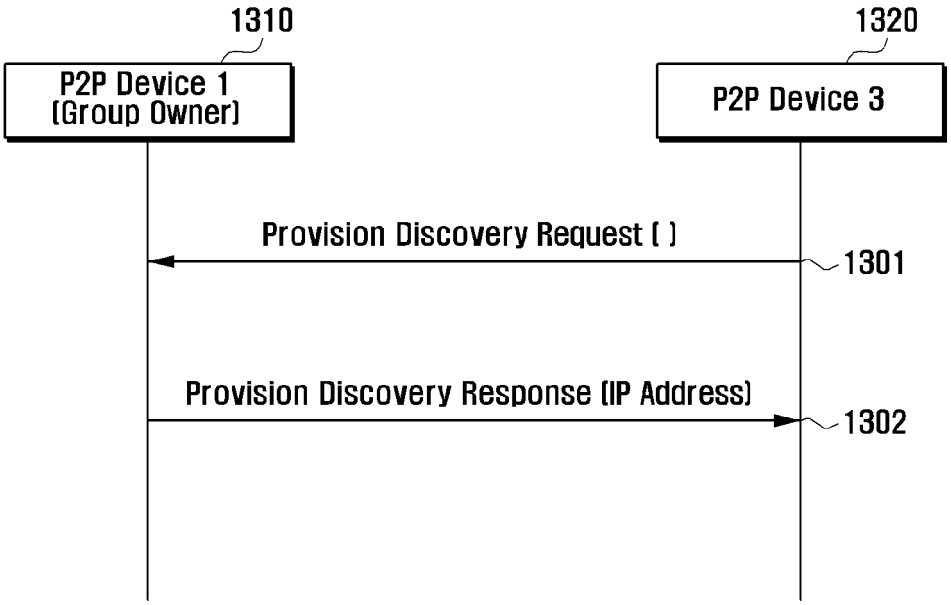
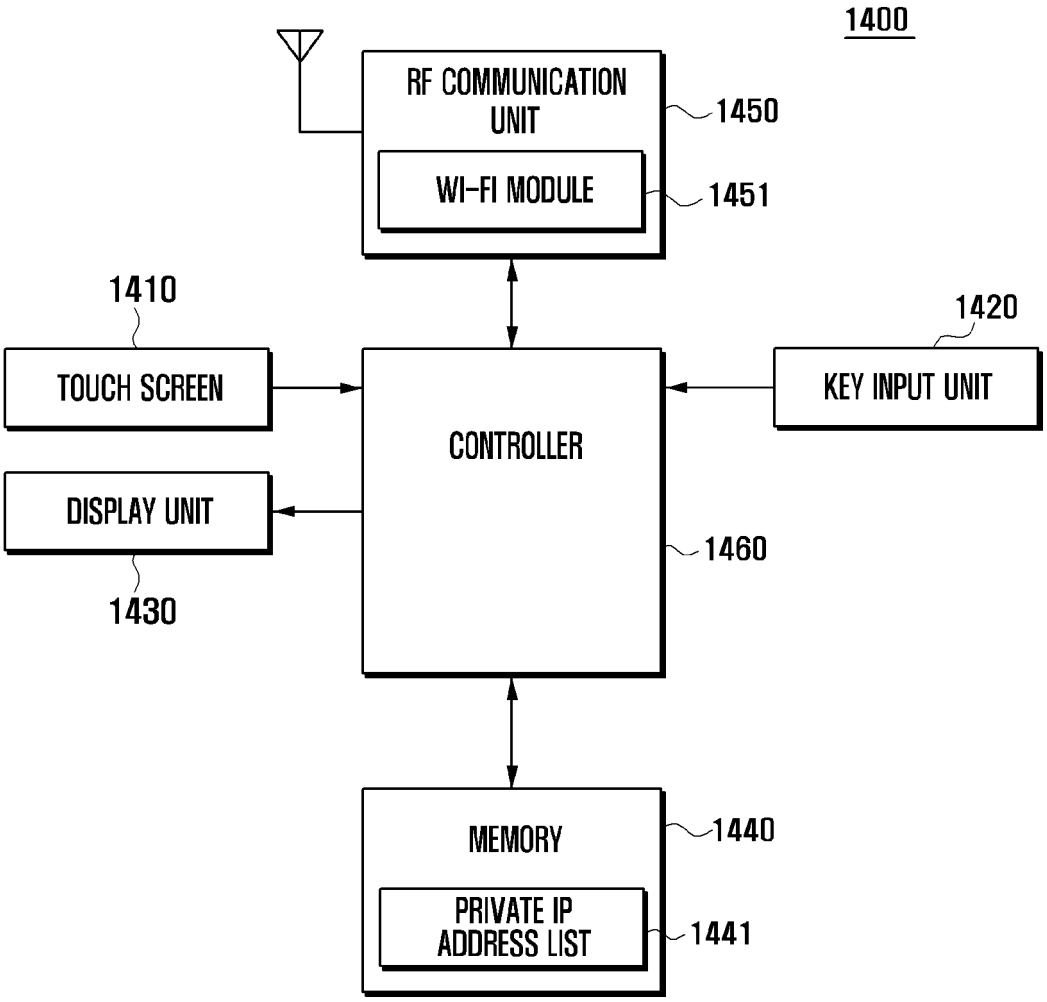

1310
P2P Device 1
(Group Owner)
1320
P2P Device 3
Provision Discovery Request ( )
1301
Provision Discovery Response (IP Address)
1302

FIG. 14


1400
RF COMMUNICATION UNIT
1450
WI-FI MODULE
1451
1410
TOUCH SCREEN
1420
KEY INPUT UNIT
CONTROLLER
DISPLAY UNIT
1460
1430
MEMORY
1440
PRIVATE IP ADDRESS LIST
1441

REFERENCES CITED IN THE DESCRIPTION

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Non-patent literature cited in the description

- IP address assignment in a mobile ad-hoc network. **MOHSIN, M. et al.** Military Communications Conference, MILCOM, Proceedings. IEEE, October 2002, vol. 2, 856-861 **[0007]**
- Wi-Fi Peer-to-Peer (P2P) Technical Specification - Draft Version 1.14. *Wi-Fi Alliance Technical Committee* **[0007]**